METAL FINISHING

REPARATION, ELECTROPLATING, COATING

PUBLISHED FOR THIRTY-SEVEN YEARS AS METAL INDUSTRY

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H-VW-M
ZINC
Plating Processes
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FEB 3 - 1943
produce fine grained, dense, ductile zinc deposits having excel
lent protection against corrosion of the underlying steel.
To war production plants now contemplating conversion from
cadmium to zinc plating, we suggest presenting your problem
to our laboratories so that the most suitable process may be
recommended. Also in this manner you can secure the maximum
use of your present equipment.
Write us or call for a field engineer.
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Manufacturers of a complete line of electroplating and polishing equipment and supplies
SINCE 1820

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TS550
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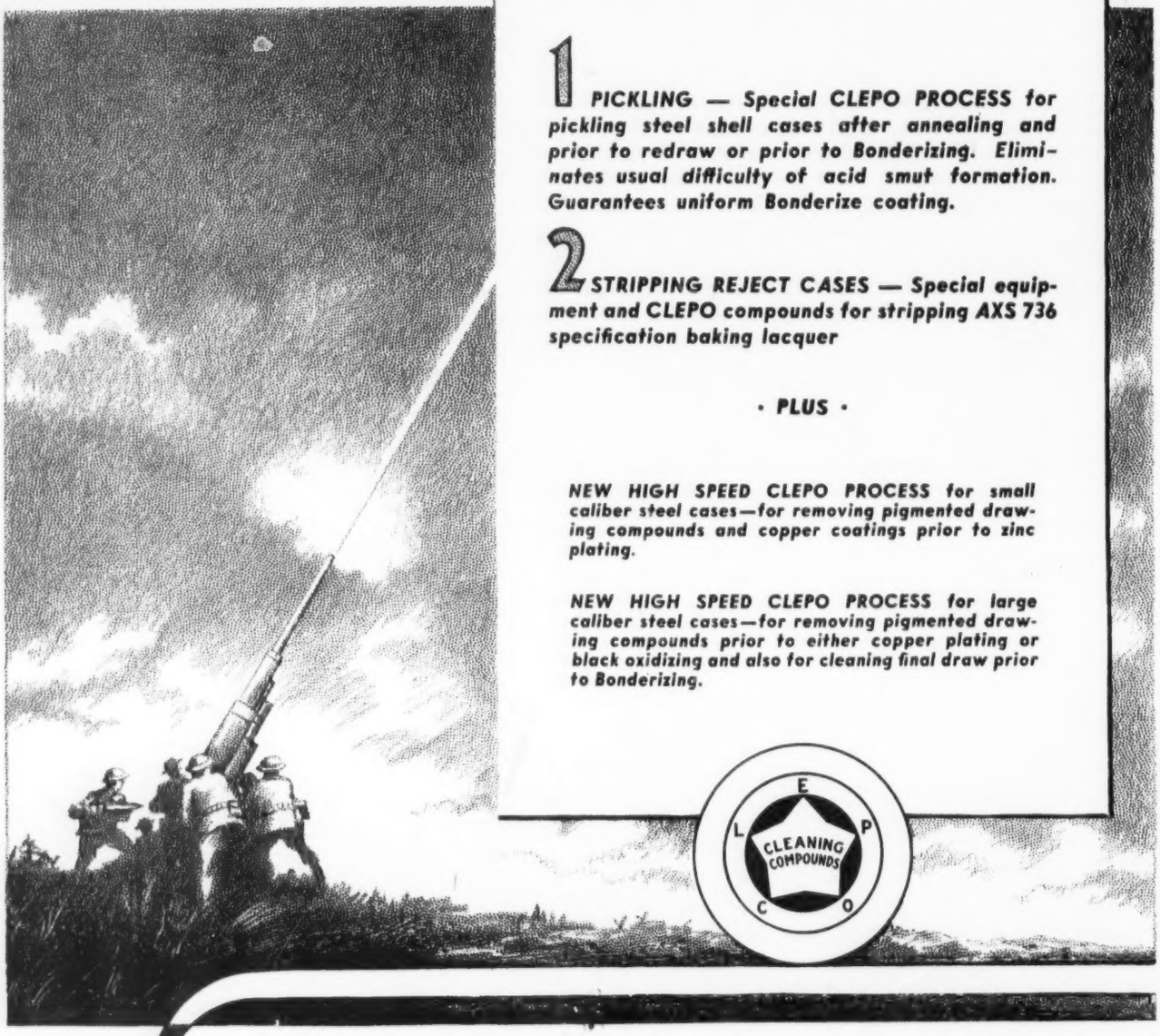
Check these 2 NEW DEVELOPMENTS FOR STEEL SHELL CASE MANUFACTURE···



1 ***PICKLING — Special CLEPO PROCESS for pickling steel shell cases after annealing and prior to redraw or prior to Bonderizing. Eliminates usual difficulty of acid smut formation. Guarantees uniform Bonderize coating.***

2 ***STRIPPING REJECT CASES — Special equipment and CLEPO compounds for stripping AXS 736 specification baking lacquer***

· PLUS ·

NEW HIGH SPEED CLEPO PROCESS for small caliber steel cases—for removing pigmented drawing compounds and copper coatings prior to zinc plating.

NEW HIGH SPEED CLEPO PROCESS for large caliber steel cases—for removing pigmented drawing compounds prior to either copper plating or black oxidizing and also for cleaning final draw prior to Bonderizing.

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FREDERICK GUMM CHEMICAL COMPANY, Inc.
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EBONOL "C" the BLACKENING PROCESS for Copper and Copper Alloys

EBONOL "C" is unique! It produces hard, adherent, black inorganic finishes (either dull or glossy) on Copper, Brass or Bronze.

It is not a sulphide type black but a cupric oxide finish, with all the physical and chemical advantages of cupric oxide. The coatings are far superior to black nickel, and require no critical materials. The finishes are easy to apply to either large single objects or small parts in bulk. Simple immersion for from 2 to 15 minutes at 200° F is all that is necessary. Control is also simple.

EBONOL "C" finishes are widely used and approved for the blackening of war goods such as optical items, measuring and precision instruments, grommets, wire products and airplane accessories.

Other metals can also be given the superior EBONOL "C" BLACK FINISH by first copper plating.

Other EBONOL Blackening Processes

EBONOL "A" for Aluminum and its alloys
EBONOL "S" for Iron and Steel
EBONOL "Z" for Zinc plate and Zinc alloys

Write for Folder "C" or send samples for processing.

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Volume 41, Number 1, January, 1943. Two Dollars Per Year.

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Announces a NEW and BETTER
BUFFING COMPOSITION

For De-burring and Other Buffing Operations—

Developed especially for use on tampico wheels and brushes—STEVENS TAMPICO COMPOSITION cuts fast—hangs well on the wheel—is easy to clean.

It works much faster than ordinary emery cake or emery paste, and other compositions usually employed for the job. It reduces wear and tear on the wheel and saves time and labor.

Many *de-burring operations* on precision parts — such as gears, and other items of war production containing "holes" or deep recesses, or, where contours are such that even a soft loose buff is not practical—can be economically accomplished with this composition, on a tampico wheel.

This material and method is especially useful on surfaces where only a very small amount of buffing is required, and great care must be exercised to maintain close tolerances; also where slight burrs must be removed without bevelling edges.

It also helps the cutting action of fine wire wheels.

Why not order ten or twenty pounds on a "satisfaction guaranteed" basis — give it a whirl — we know you'll like it.

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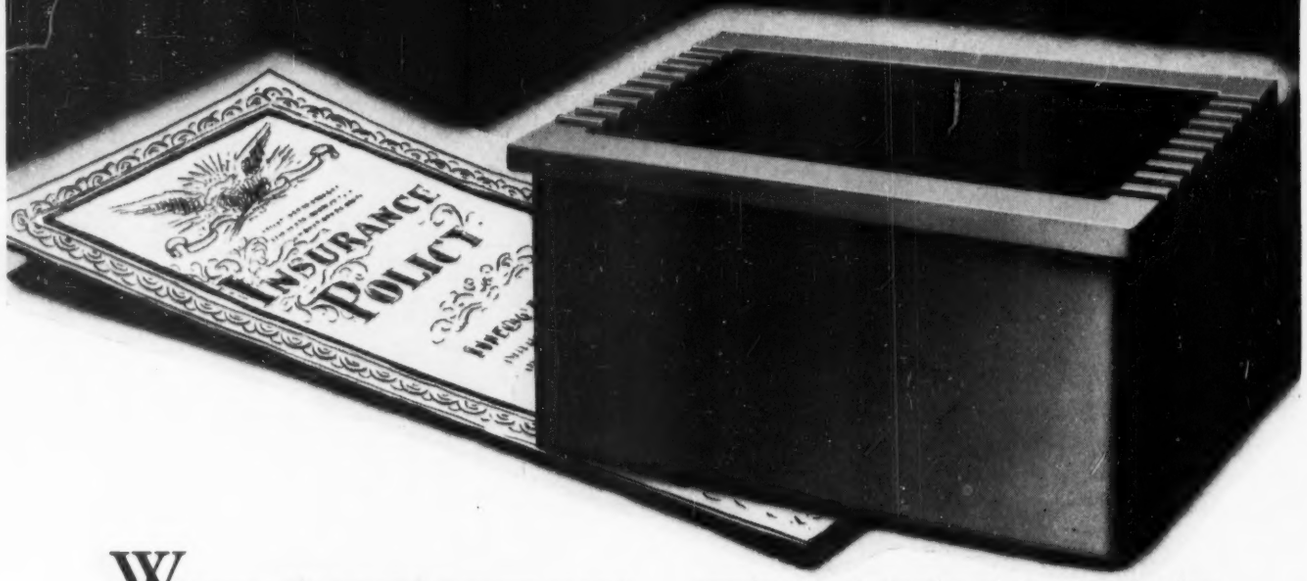
"EVERYTHING FOR THE POLISHING AND PLATING PLANT"

CHEMICAL STONEWARE TANKS

ACID PROOF INSURANCE



Wherever tanks are used to process or store chemicals, or where unusual resistance to chemical corrosion is demanded, General Ceramics Chemical Stoneware can be installed with complete confidence.

By replacing tanks made of hard-to-get materials with Chemical Stoneware, electroplating plants will reap a harvest of benefits. Chemical Stoneware Tanks are not merely acid resistant, but acid proof throughout — the entire body is built to withstand acids and concentrated chemicals. The shiny, glazed surface will not chip or peel and is easy to keep clean, thus assuring the elimination of dangerous product contamination. Stoneware tanks are constructed without seams eliminating a source of leakage hazardous to property and personnel.

Get extra *acid proof* protection by installing General Ceramics Chemical Stoneware equipment.

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KEASBEY, NEW JERSEY

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CHEMICAL STONEWARE

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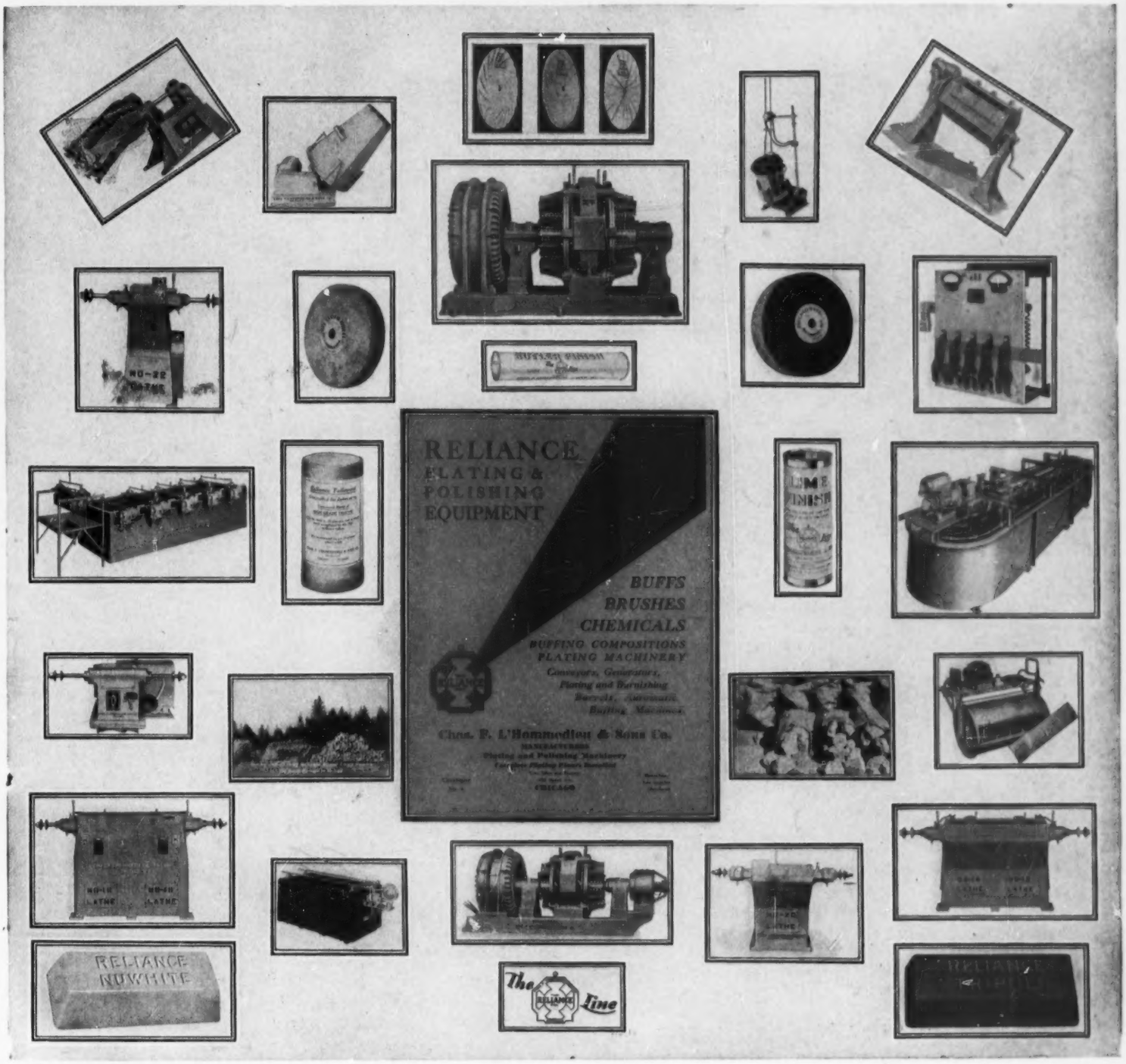

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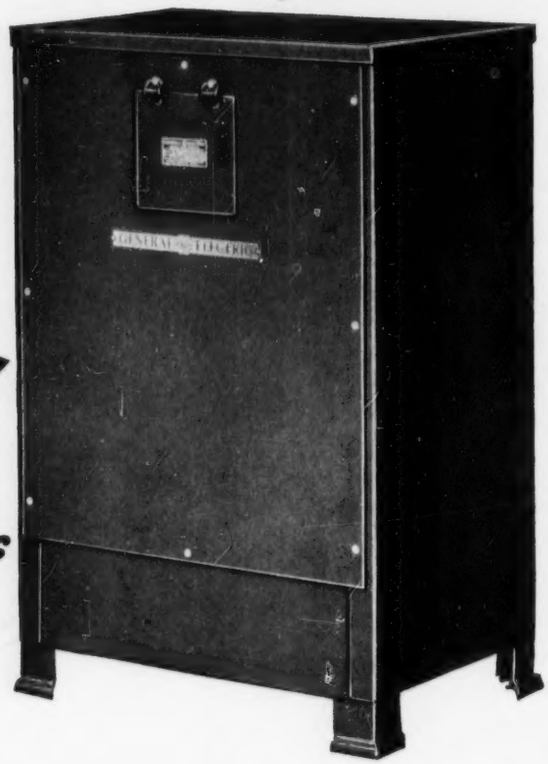

They Help You Save FIVE *Ways*

1. LOW FIRST COST. By standardizing the G-E Copper Oxide Rectifier to two sizes designed to be operated in parallel, series, or series-parallel to meet all requirements, manufacturing economies are realized by us—which means a lower initial investment for you.

2. LOW INSTALLATION COST. The compactly built G-E Rectifier requires no special foundation—which means it can be moved easily to the exact spot where it can work most efficiently.

3. LOW OPERATING COST. Current losses are reduced to a minimum by accurate control of A-c voltage input and D-c output. Further, the losses inherent in bus bars and tank rheostats are reduced to the minimum.

4. LOW MAINTENANCE COST. G-E Rectifiers have no moving parts to require care or to wear out and need replacing. The only exception is the low-powered, ball-bearing equipped fan which should be lubricated once a year.

5. FLEXIBLE FOR HIGH EFFICIENCY. G-E Rectifiers are designed specifically for flexibility in use. They can be installed anywhere since the regulator is installed adjacent to the tank and gives complete control of the rectifiers.

Get this new catalog now on the way G-E Copper Oxide Rectifiers for Electroplating and Anodizing will serve your needs. Write to Section A133-75, Appliance & Merchandise Department, Bridgeport, Connecticut.

GENERAL ELECTRIC

DIES THAT DON'T "DIE YOUNG"

How a wire manufacturer speeds output and saves by using a Pennsalt Cleaner

"Our wire drawing dies aren't lasting as long as they should," decided the production men in a leading steel mill. "And tungsten carbide dies are getting harder to replace, now that expert die makers are scarcer than hen's teeth."

What to do?

A Penn Salt representative helped find the answer . . . better cleaning of the wire before drawing. After studying the problem, he suggested using the one of our series of Pennsalt Cleaners best suited for this job.

Success! Tungsten carbide dies in this steel mill now last 15-20% longer. There is less scrap loss and less scratching of wire. Rusty wire, requiring reprocessing, has been practically eliminated by dipping the wire first in a Pennsalt Cleaner solution and then in lime, before drawing. And, in addition, cleaner costs have been substantially reduced by comparison with the former metal cleaner used.

Most important of all, the longer die life, lower scrap loss and elimination of rusty wire . . . achieved with the aid of this Pennsalt Cleaner . . . helped *speed up production* of wire rope and other wire products vitally needed for Defense.

Today Pennsalt Cleaners are helping to speed up Defense in many other ways . . . by saving time, labor and materials in plants making metal parts for airplanes, tanks, naval craft, guns and other munitions.

There's a Pennsalt Cleaner designed to meet practically every kind of metal cleaning problem. What's *your* specific need in a metal cleaner? Our technical staff, backed by adequate supplies of all Pennsalt Cleaners, is at your service. Phone, wire or write our Pennsalt Cleaner Division, Dept. M.F.

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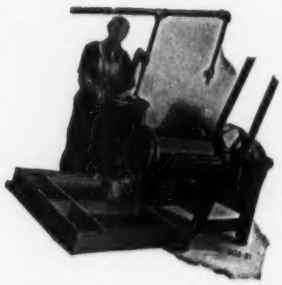
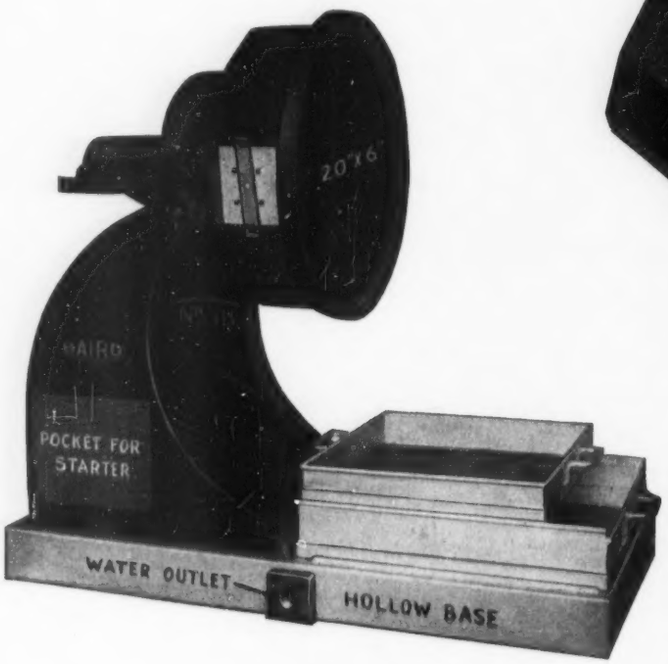


HORIZONTAL BARRELS **TILTING BALL BURNISHING BARRELS**



This shows a High and Narrow Type of Barrel mounted on "Baird" Model D. or Pedestal Type Motor driven Oblique Tilting Tumbler.

As shown the barrel was lined for use for burnishing with hardened steel balls.

These barrels may be of any suitable material depending on the job. Cast iron or fabricated steel unlined or lined with rubber etc. for rolling in abrasives.

Made in 20" dia. x 6" for No. 1 Tumbler
Made in 24" dia. x 8" for No. 2 Tumbler

This shows the side of a No. 1 BAIRD Model D. Single Oblique Tilting Tumbler with a No. 22 Sheet Steel Polygonal Barrel and with an Automatic Electrical Tilting Device.

This device AFFORDS GREATEST SAFETY—LEAST LABOR—LEAST FLOOR SPACE—LEAST AMOUNT OF DISTANCE TO MOVE WORK in USING the tumbling barrels. SAVES TIME AND FLOOR SPACE.

When tumbling questions come up "ASK BAIRD ABOUT IT"

THE BAIRD MACHINE COMPANY

BRIDGEPORT, CONNECTICUT

Since 1846 specializing in high production machinery for articles of wire and for ribbon metal. Also machines to turn, bore, etc., castings, forgings, etc., up to 10½" diameter.

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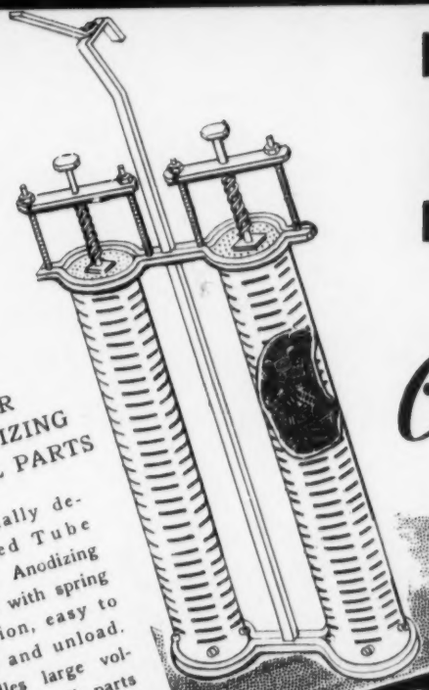
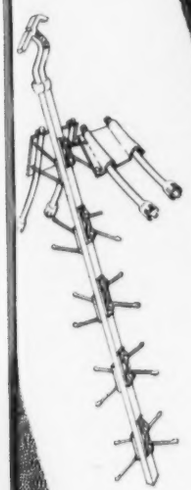
Answer for PLATING *and* ANODIZING SMALL PARTS



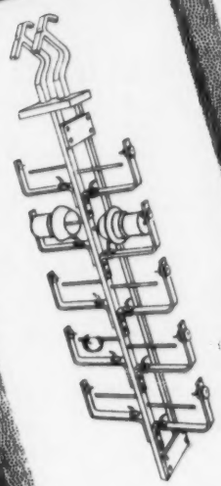
FOR ANODIZING SMALL PARTS

Specially designed Tube Type Anodizing Rack with spring tension, easy to load and unload. Handles large volume of small parts with each batch.

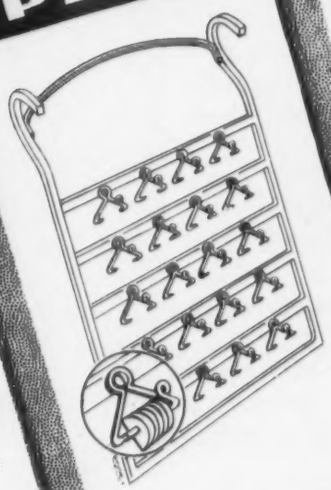
• FOR PLATING •



10-H Type Insulated Rack for Cadmium or Zinc Plating special ordnance parts. Contact springs made of bronze wire (removable).

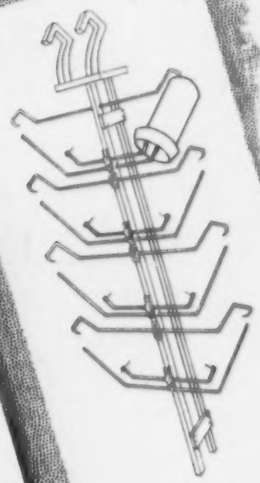


10-H Type Inside Plating Rack with Cathode and Anode constructed in one unit specially designed for inside plating large fuse parts.



Belke Arch Type Zinc Plating Rack designed for zinc plating condenser parts.

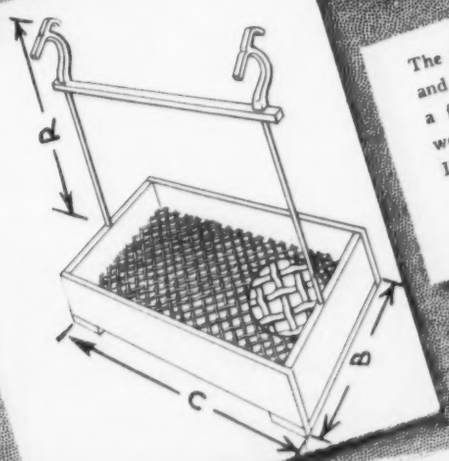
12-H Type Cathode and Anode Rack for inside and outside plating of fuse body parts.



8-H Type Rack for inside and outside plating of extra large ordnance parts.

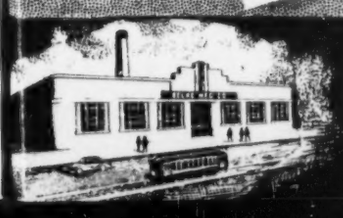
FOR PLATING SMALL PARTS

A real money saving and handy plating basket for plating small quantities of miscellaneous parts. Has Bakelite frame with removable screen mesh bottom. Nothing takes plate except articles in bottom. Will not shade work. Sturdily constructed and will give years of service.



The above illustrated Plating and Anodizing Racks are only a few of the many designs we are supplying the Plating Industry.

All Belke Inside Anode Plating Rack Designs patented—No. 179,837.

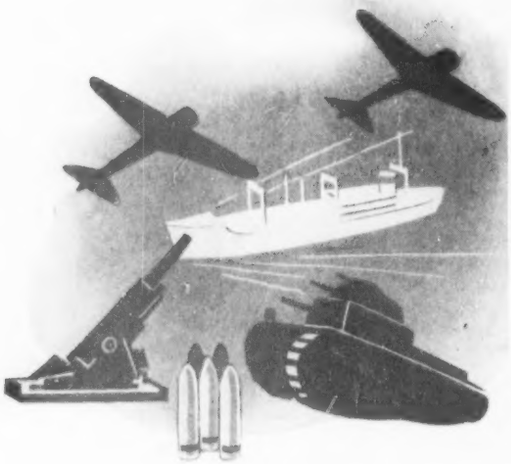


BELKE MFG. CO.

947 N. CICERO AVE., CHICAGO

REFINING

serves the WAR EFFORT, *too*–



Many think of Refining as a service required mostly by the arts and specialized industries that use silver, gold and platinum.

But war production is rapidly changing this idea, especially where silver is concerned. Enormous quantities are going into airplanes, ships, tanks, guns, bombs and shells . . . with corresponding amounts of scrap and waste.

All over the country manufacturers are putting the responsibility of getting this vital metal back into use up to our refining department.

From our reputation as refiners they have found out about our long experience and well known processing and assaying methods and about the speed and accuracy we are in the habit of giving.

Working day and night, this Refining war task now steps along at high speed. Our service to silversmiths, jewelry manufacturers and regular users of precious metals goes on as usual.

Isn't this an ideal time to find out what Handy & Harman's long standing reputation really means? We feel certain our prompt, accurate service will please you. Try us with your next shipment.

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War on *Wear!*

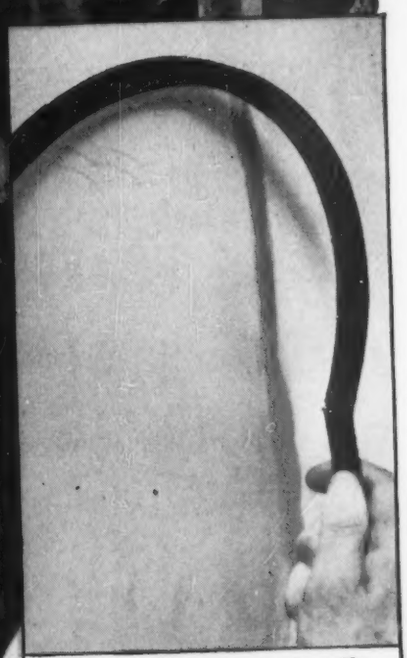
MANHATTAN'S Suggestions for the Care of V-BELTS

Rubber has so many essential applications in the war production program that scarcity must be overcome by conservation in every way possible.

Making V-Belts last longer is more than common sense; it is a patriotic contribution to the "winning-power" of the country. Follow these important suggestions:—

1. Do not allow oil, grease or gasoline to come in contact with belt.
2. Avoid exposing belts to sunlight and excessively hot or cold weather.
3. Provide take-up facilities.
4. Don't leave tools or other objects near belt to get caught in drive.
5. Avoid abrasion on nearby objects.
6. Do not force belts onto sheave with instruments of any kind. Slack off on take-up and place belts into grooves.
7. Work belts around grooves until all of the slack is on ONE SIDE OF THE DRIVE, then tighten take-up until belts are fairly snug.
8. Before starting check pulley alignment, check bearings for oil and see that drive is clear and free. Adjust take-up so that when drive is operating at full load and full speed, only a slight bow appears on slack side. Vertical drives, extremely short center drives, and drives carrying pulsating loads must be operated tighter than others.
9. Use sufficient number of correct sized belts to handle maximum load. Be sure sheaves are over accepted minimum diameters.
10. Design new drive to take standard belt and sheave sizes.
11. Belts must not bottom in grooves. Bottoming causes belt-destroying heat from slip.
12. Do not use belt dressing. If belts slip, clean with cloth dampened in gasoline and tighten drive slightly.
13. See that sheave grooves are free from burs and extreme wear. Replace worn sheaves and check alignment periodically.
14. On failure of first belt on a drive, replace entire set with new belts, keeping worn belts as spares for subsequent failures.
15. Store belts uncoiled and hung over forms on rack or wall in a cool, dark place.
16. Consult your MANHATTAN service man. Write factory or your distributor.

You can get reprints of these suggestions for maintenance men from MANHATTAN field representatives or distributors or by writing direct. This is No. 3 of a series on rubber conservation. Wall cards on care of belts and hose are also available.



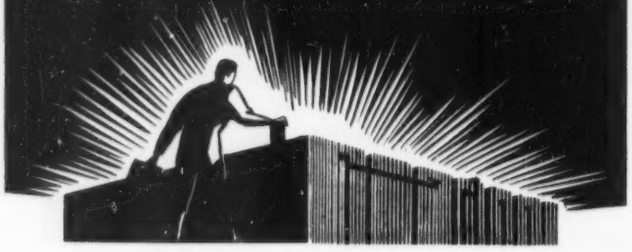
V-Belt destroyed by insufficient tension. High slip created excessive heat which wore and cracked cover.

KEEP AHEAD WITH MANHATTAN

Conserve your rubber equipment; salvage worn out rubber and buy WAR BONDS—three steps to Victory.

THE MANHATTAN RUBBER MANUFACTURING DIVISION
of RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES PASSAIC, NEW JERSEY

how TO SPEED UP WAR PRODUCTION!



Turco Products will help you speed up production by furnishing materials and methods which do a better, safer and quicker job in every department where desoiling, surface preparation or maintenance operations are handled.

In preparation for anodizing or chromatizing; for phosphatizing; for spot welding and weld-masking; for degreasing and decarbonizing of machine parts, and all of the operations listed on the coupon below, there is a thoroughly tested Turco Specialized Industrial Chemical Compound.

TURCO

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TURCO CAN HELP YOU SEND FOR INFORMATION NOW!

TURCO PRODUCTS, INC.
6135 S. Central, Los Angeles 27-13

Please send FREE literature on materials, methods and procedure pertaining to the operations checked below:

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FIRM _____

ADDRESS _____ STATE _____

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- ☐ Aluminum Spot Welding
- ☐ Anodizing
- ☐ Cadmium Plating
- ☐ Chemical Vapor Cleaning
- ☐ Chromatizing
- ☐ Cleaning Metals Before Processing
- ☐ Cleaning Prior to Plating
- ☐ Cold Immersion Cleaning
- ☐ Cold Spray Cleaning
- ☐ Floor Maintenance
- ☐ Glass Cleaning
- ☐ General Plant Maintenance
- ☐ Hot Immersion Cleaning
- ☐ Magnesium Processing
- ☐ Paint Camouflage Cleaning
- ☐ Paint Department Maintenance
- ☐ Paint Stripping
- ☐ Phosphatizing
- ☐ Scale Removal and Control
- ☐ Stainless Steel Processing
- ☐ Steam Boiler Maintenance

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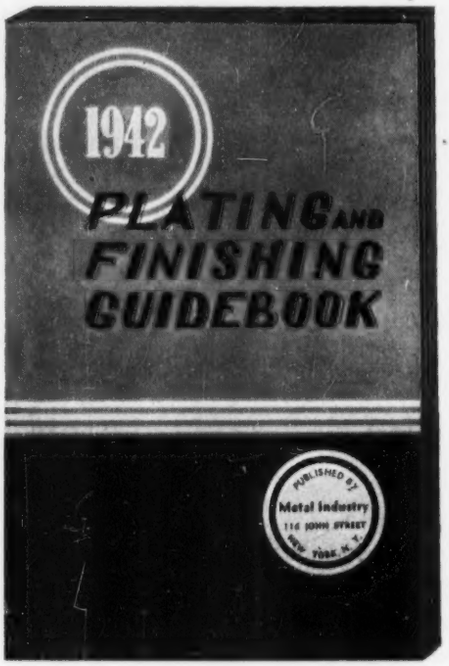

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METAL FINISHING

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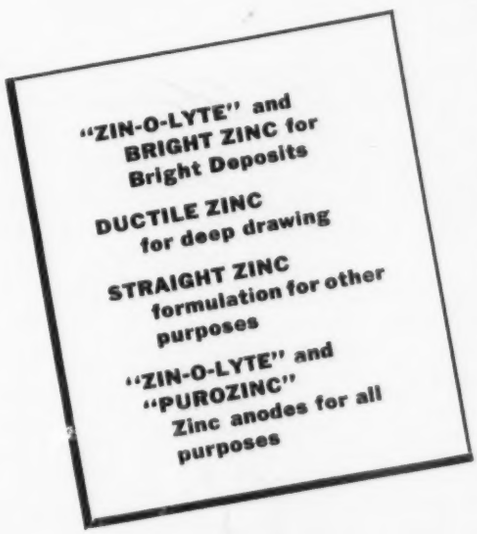
HOW TO MEET TODAY'S REQUIREMENTS FOR

Cyanide Zinc Plating

War-time production has brought about revisions of many plating specifications. Wherever possible, zinc is replacing cadmium, a metal of increasing scarcity. A change-over to meet new conditions does not have to be a serious problem. Materials, processes and technical assistance for their proper application are available from du Pont.

The requirements of specialized types of work can be met through the use of one or more of these processes. The proper plating solution can be easily installed and used in usual plating equipment. Procedures have been simplified so that every experienced plater can easily get either dull or bright zinc plate on a wide variety of work. With the right process and the high quality of du Pont materials, such as zinc anodes, zinc cyanide and sodium cyanide, every plater can get consistently good results.


"ZIN-O-LYTE" and BRIGHT ZINC for Bright Deposits
DUCTILE ZINC for deep drawing
STRAIGHT ZINC formulation for other purposes
"ZIN-O-LYTE" and "PUROZINC" Zinc anodes for all purposes

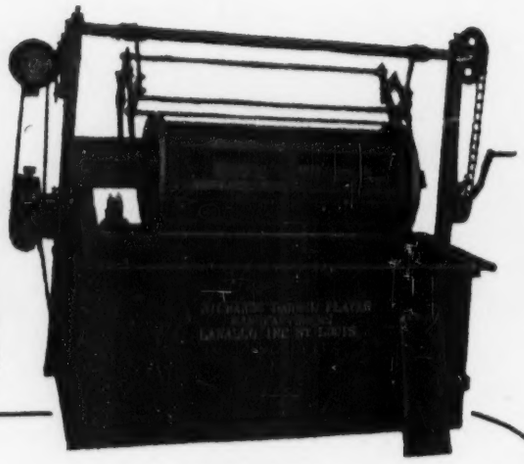
Which du Pont zinc process to use? It depends upon what material and equipment you are working with and what type of surface you want to get. A competent group of technical men with many years of experience in all types of plating will be glad to discuss your plating problems and help in the selection and application of processes and materials. Just call the Electroplating Division, E. I. du Pont de Nemours & Company (Inc.), Wilmington, Delaware.

DU PONT
REG. U. S. PAT. OFF.

ELECTROPLATING CHEMICALS PROCESSES AND SERVICE

BETTER THINGS for BETTER LIVING THROUGH CHEMISTRY

Give Your Plating and Finishing Room Problems to a LASALCO ENGINEER



Barrel Plater

Burnishing Barrel

Here is a list of some of the equipment and supplies he has available to give you the *right* solution quickly.

Plating Barrels:
- Utility
- Bull's Eye
- Richards

Burnishing Barrels
Tumbling Barrels
Cushioned Belt Grinders
Electric Sawdust Tumblers
Full Automatic Machines
Semi-Automatic Machines
Hard Chrome Equipment
Anodizing Equipment
Magnesium Treating Equipment
Descaling Equipment

Special Plating Machines to meet any requirement
Buffs and Polishing Wheels
Tripoli
White Finish
Chrome Composition
Emery Cake
Grease Stick
Stainless Steel Composition
Crocus

Anodes:

Nickel	Cadmium
Copper	Lead
Brass	Gold
Zinc	Silver

Cushioned Belt Grinder

Complete Line of Chemicals and Supplies for Plating

Nickel Salts
Chromic Acid
Sodium Cyanide
Copper Cyanide
Zinc Cyanide, etc.

Sangamo Amperehour Meters
Cadalyte Cadmium Solution
Zin-O-Lyte Zinc Solution
DuPont Hi-Speed Copper
Chandeysson Generators
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Dipping Baskets
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Scrub Brushes
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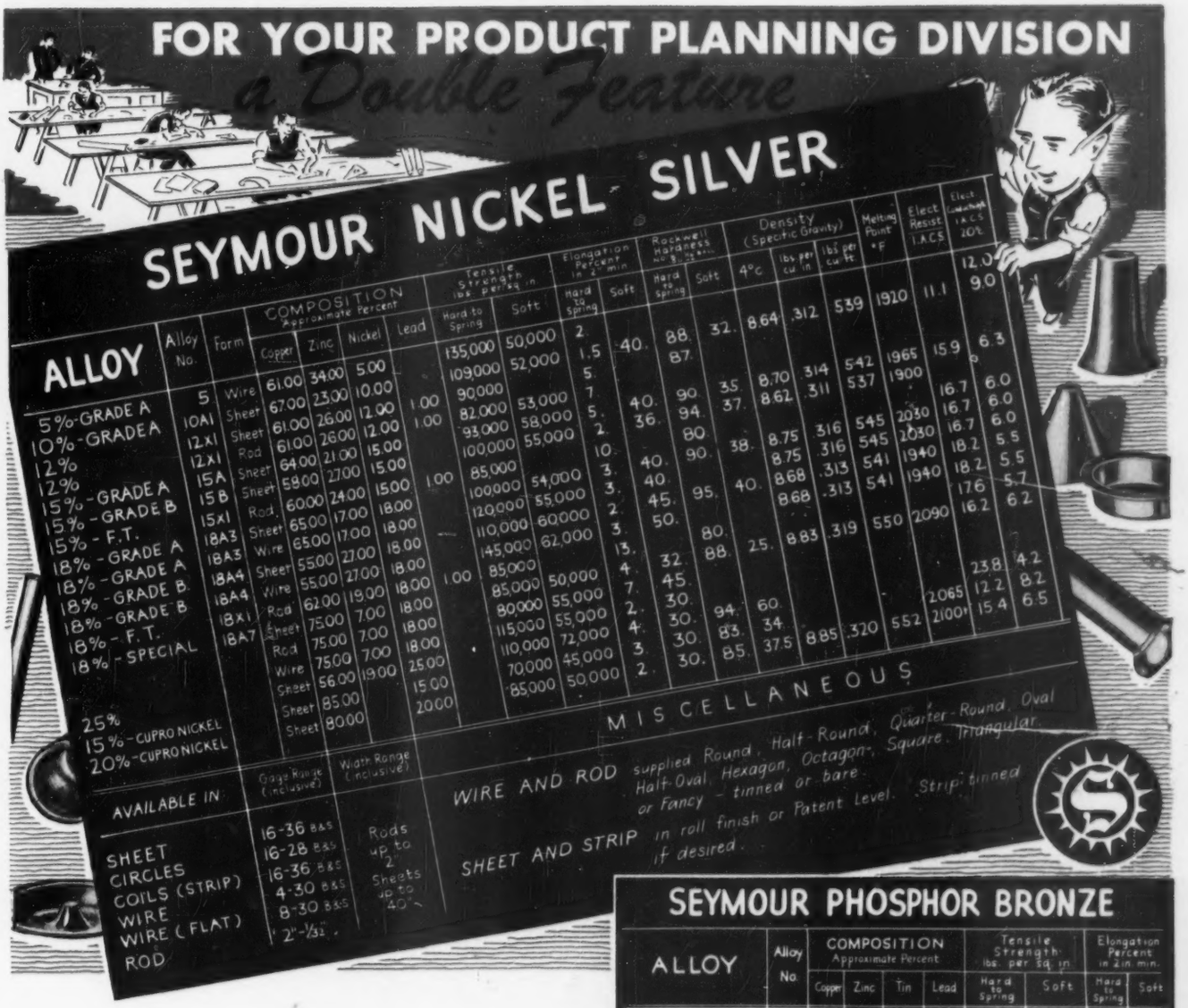
Maizo Meal
Copper Wire
Insulating Steam Joints
Rheostats
Test Sets
Plating Racks
Stop-Off Lacquers
Rack Lacquers

Write today for complete information
— or ask a Lasalco Engineer to call.

LASALCO, INC.

2818-38 LaSalle St., St. Louis, Mo.


FOR YOUR PRODUCT PLANNING DIVISION
a Double Feature
SEYMOUR NICKEL SILVER
ALLOY
Alloy No.
Form
COMPOSITION Approximate Percent
Copper
Zinc
Nickel
Lead
Tensile Strength lbs. per sq. in.
Hard to Spring
Soft
Elongation Percent in 2" min.
Hard to Spring
Soft
Rockwell Hardness
Hard to Spring
Soft
Density (Specific Gravity)
4°C
lbs. per cu. in.
lbs. per cu. ft.
Melting Point °F
Elect. Resist. I.A.C.S.
Elect. Conductivity I.A.C.S. 20°C
5%-GRADE A 5 Wire 61.00 34.00 5.00 135,000 50,000 2 88. 32. 8.64 .312 539 1910 11.1 12.0
10%-GRADE A 10A1 Sheet 67.00 23.00 10.00 109,000 52,000 1.5 40. 87. 9.0
12% 12A1 Sheet 61.00 26.00 12.00 1.00 90,000 5. 7
12% 12A1 Rod 61.00 26.00 12.00 1.00 82,000 53,000 5. 40. 90 35 8.70 .314 542 1965 15.9 6.3
15%-GRADE A 15A Sheet 64.00 21.00 15.00 93,000 58,000 2. 36. 94. 37. 8.62 .311 537 1900 16.7 6.0
15%-GRADE B 15B Sheet 64.00 21.00 15.00 100,000 55,000 10. 80 16.7 6.0
15%-F.T. 15A1 Rod 60.00 24.00 15.00 1.00 85,000 3. 40. 90. 38. 8.75 .316 545 2030 16.7 6.0
18%-GRADE A 18A3 Sheet 65.00 17.00 18.00 100,000 54,000 3. 40. 8.75 .316 545 2030 18.2 5.5
18%-GRADE A 18A3 Wire 65.00 17.00 18.00 120,000 55,000 3. 45. 95. 40. 8.68 .313 541 1940 18.2 5.5
18%-GRADE B 18A4 Sheet 55.00 27.00 18.00 110,000 60,000 2 50. 8.68 .313 541 1940 17.6 5.7
18%-GRADE B 18A4 Wire 55.00 27.00 18.00 145,000 62,000 3 80. 16.2 6.2
18%-F.T. 18A1 Rod 62.00 19.00 18.00 1.00 85,000 13. 88. 25. 8.83 .319 550 2090
18%-SPECIAL 18A7 Sheet 75.00 7.00 18.00 85,000 50,000 4 32 23.8 4.2
Rod 75.00 7.00 18.00 80,000 55,000 7 45. 12.2 8.2
Wire 75.00 7.00 18.00 115,000 55,000 2. 30. 94. 60. 15.4 6.5
Sheet 56.00 19.00 25.00 110,000 72,000 4. 30. 83. 34. 2065
Sheet 85.00 15.00 70,000 45,000 3 30. 85. 37.5 8.85 .320 552 2100
Sheet 80.00 20.00 85,000 50,000 2. 30.
25%
15%-CUPRO NICKEL
20%-CUPRO NICKEL
MISCELLANEOUS
AVAILABLE IN:
Gage Range (Inclusive)
Width Range (Inclusive)
SHEET 16-36 B&S
CIRCLES 16-28 B&S
COILS (STRIP) 16-36 B&S
WIRE 4-30 B&S
WIRE (FLAT) 8-30 B&S
ROD 2"-1/32"
Rods up to 2"
Sheets up to 40"
WIRE AND ROD supplied Round, Half-Round, Quarter-Round, Oval, Half-Oval, Hexagon, Octagon, Square, Triangular, or Fancy - tinned or bare.
SHEET AND STRIP in roll finish or Patent Level. Strip tinned if desired.

SEYMOUR PHOSPHOR BRONZE

ALLOY	Alloy No.	COMPOSITION Approximate Percent				Tensile Strength lbs. per sq. in.		Elongation Percent in 2 in. min.	
		Copper	Zinc	Tin	Lead	Hard to Spring	Soft	Hard to Spring	Soft
GRADE A (Sheet)*	950	95.00		5.00		105,000	45,000	15	50
" B (Rod)*	494	94.00		5.00	1.00	61,000	50,000		40
" C (Sheet)*	928	92.00		8.00		112,000	55,000	3	
" D (")*	910	90.00		10.00		115,000	60,000	5	65
PHOSPH. BRONZE (Rod)*	444	88.00	4.00	4.00	4.00	*60,000 (Small Size Only)		20	

* Contains Phosphorus

DITTO	Alloy No.	Rockwell Hardness No. "F" Ball 100 Kg.		Density or Spec. Grav.			Melting Point °F	Elect. Resist. I.A.C.S.	Elect. Conductivity % I.A.C.S. 20°C
		Hard to Spring	Soft	4°C	lbs. per cu. in.	lbs. per cu. ft.			
DITTO	950	95	30	8.86	.320	552	1920	6.1	16.5
	494	85						6.0	16.8
	928	98	38	8.80	.318	549		7.8	12.8
	910	100	52	8.76	.316	546		9.4	10.6
	444	75		8.86	.320	552	1830	8.2	12.2

AVAILABLE IN:	Gage Range (Inclusive)	Width Range (Inclusive)	MISCELLANEOUS
SHEET	16-36 B&S	Rods up to 2"	WIRE AND ROD supplied Round, Half-Round, Quarter-Round, Oval, Half-Oval, Hexagon, Octagon, Square, Triangular or Fancy - tinned or bare.
BRIDGE PLATES	3/16"-7/8"		
CIRCLES	16-28 B&S		
COILS (STRIP)	16-36 B&S		SHEET AND STRIP in roll finish or Patent Level. Strip tinned if desired.
WIRE	4-30 B&S	Sheets up to 40"	
WIRE (Flat)	8-30 B&S		
ROD	2"-1/32"		
ROD (Welding)			

HUNTING for data these days is expensive. Yet, a good understanding of the possibilities of materials being worked is necessary for best results. So, to save your time, here are the principal characteristics of two Seymour Alloys—long-time stand-bys in peace production, now vital features in war production:

SEYMOUR NICKEL SILVER — Takes any hardness from dead soft to spring temper. Excellent for deep draws and difficult spinning. Has fine grain and good corrosion resistance. Its silvery white color makes it an ideal base for plated items. Leaded, it machines freely.

SEYMOUR PHOSPHOR BRONZE — Highly resistant to corrosion, abrasion, friction and fatigue. Produces springs that withstand almost indefinite flexure. Practically indifferent to thermal variation in most ordinary uses. Has wide application in electrical design. Available leaded; also in rods for welding.

SEYMOUR

Non-Ferrous Alloys Since 1878

THE SEYMOUR MFG. CO., SEYMOUR, CONN.

ADVANCE SAUCER WHEEL

Reaches those "Hard to Get" places

The illustration clearly shows how the underside of a bolt head or work of a similar nature can be polished so as to retain its 90 degree angle.

The side of the wheel does not touch the shank of the bolt therefore eliminating the danger of destroying or marring the thread.

The ADVANCE SAUCER WHEEL plays an important part in the production of war material and is invaluable where tolerances must be held very close.

The illustration to the left shows an ADVANCE SAUCER WHEEL 10" Dia. x 1" Face, x 1¼" Spindle hole with a draw ½" deep . . . Wheel is flat on both sides around the hole to permit the flanges and nut to hold the wheel securely on Polishing spindle.

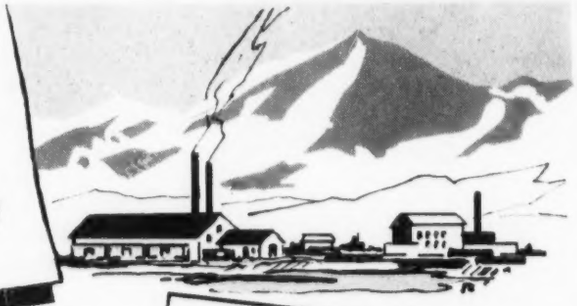
Made in even sizes from 8" Dia. to 16" Dia. with the draw in proportion to the Diameter.

"Tailor Made" to fit your requirements.

ADVANCE POLISHING WHEELS, INC.

844 WEST 49th PLACE **CHICAGO, ILLINOIS**

A PUMICE TO MEET EVERY NEED



Not until Valencia — the standard of American Pumice— was discovered at Grants, New Mexico, was it thought that a domestic pumice could match the quality of imported Italian Pumice. This inexhaustible deposit at Grants is true pumice stone and not a volcanic ash. It is physically and chemically equal in every respect to the now unobtainable Italian Pumice. • The Valencia plant's output of grades for every need is rigidly under control for particle size, purity, weight and color.

Check this table comparing Valencia with the highest grade of imported Italian Pumice. See for yourself that Valencia is truly the standard of American Pumice.

	American Pulverized Per Cent	Italian Select Per Cent
Silica	72.90	73.24
Alumina	11.28	10.61
Iron Oxide	.86	1.57
Titanium Oxide	.06	.10
Calcium Oxide	.80	1.10
Magnesium Oxide	.36	.40
Soda	3.64	3.03
Potash	4.38	5.58
Sulphuric Anhydride	.03	.05
Loss on ignition	5.20	4.04

Distributors of
THE PUMICE CORPORATION
of
AMERICA
GRANTS NEW MEXICO

WHITTAKER, CLARK & DANIELS, INC.
260 WEST BROADWAY • NEW YORK CITY
Warehouses: Detroit, Michigan and South Kearny, N. J.

3497

capture

FUMES *and* VAPORS

at their source

These unseen enemies of production and good working conditions must not be tolerated.

KIRK & BLUM Fume Exhaust Systems will capture fumes and vapors in your plant and provide clean, adequate ventilation. Our systems are designed and installed by engineers and mechanics whose backgrounds cover a period of more than a third of a century of specialized experience.

Consult our engineers, there's no obligation.

Send for any of the following booklets:

- "Dust Collecting Systems in the Metal Industries."
- "Fan Systems for Various Industries."
- "Industrial Ovens."
- "Blower Systems for Wood-working Plants."
- "Cooling Systems for the Glass Industry."
- "Data on Kirk & Blum Production Facilities."

THE KIRK & BLUM MANUFACTURING CO.
AN ORGANIZATION OF ENGINEERS AND MECHANICS
2859 SPRING GROVE AVE. CINCINNATI, OHIO

TRADE MARK
MATCHLESS
REG. U.S. PAT. OFF.

ATTENTION!!

ARMY

OF WAR PRODUCTION WORKERS.

HAVE YOU RECEIVED YOUR SAMPLE OF

MATCHLESS

NEW SHARP GREASELESS COMPOUND

For

HARD STEEL, ALL TYPES OF BURRING

And

A SPEED UP COMPOUND IN GENERAL?

A Request Will Bring It

There is no substitute for "MATCHLESS"

THE MATCHLESS METAL POLISH CO.

840 W. 49th Pl., Chicago, Ill. **726 Bloomfield Ave., Glen Ridge, N. J.**

Now that Platinum and Rhodium are out for the duration, investigate

PALLITE
TRADE MARK

The New and Perfected

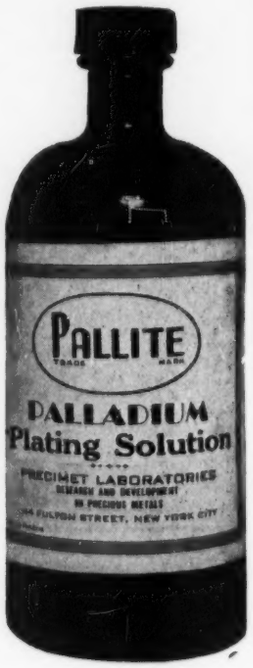
PALLADIUM PLATING BATH*

PLATE with

PALLITE PALLADIUM PLATING SOLUTION

to get the brilliant Non-Tarnishing Plate.

To be applied on low carbon steel, an undercoating of silver (half-thousandths thick), must be applied before plating with PALLITE. This will be necessary to make steel rust-proof.



* Pat. Pending

PRECIMET LABORATORIES
Division of GEORGE C. LAMBROS - Refiners and Smelters
RESEARCH AND DEVELOPMENT ENGINEERS IN PRECIOUS METALS
64 FULTON STREET **NEW YORK**

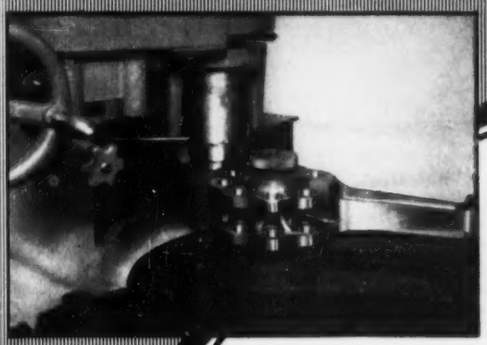
FOR THAT EXACT FINISH AND FASTER PRODUCTION

Our methods show definitely that a better finish can be obtained faster if NUGLU, FINISHING NUGLU and BURRING and BRUSHING COMPOUND are used.

J. J. SIEFEN CO.
DETROIT

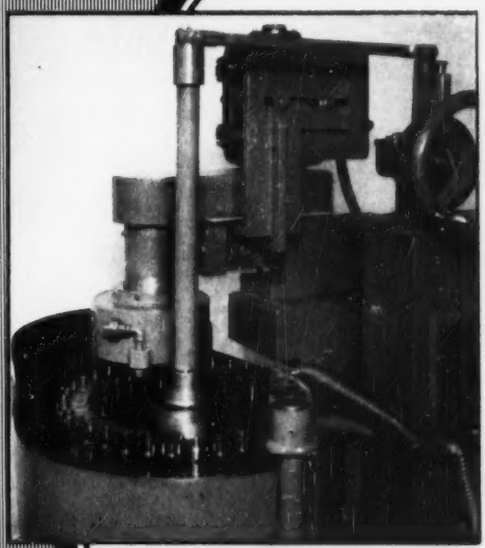
Solving the Man-Power Shortage

in POLISHING..BUFFING..
WIRE BRUSHING..BURRING



Special Acme Machine for polishing engine parts. Saves 3 to 7 operators per shift. More uniform production with less scrap.

Special Acme Machine with belt heads — for polishing small parts. Multiplies daily production, with greatly reduced man-power.

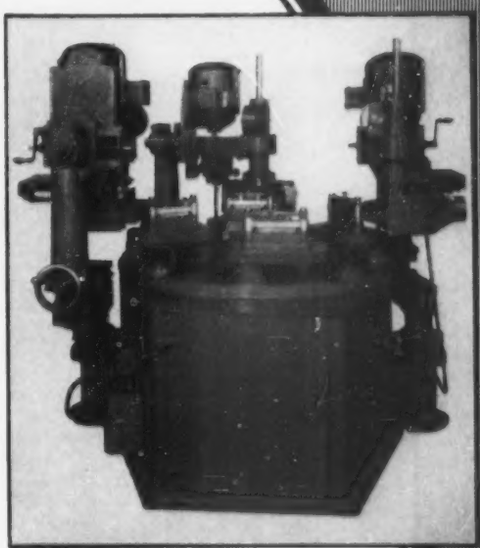


When Your Workers Leave

for the Fighting Front,
put "Acme Automatics"
on the Production Front!

•

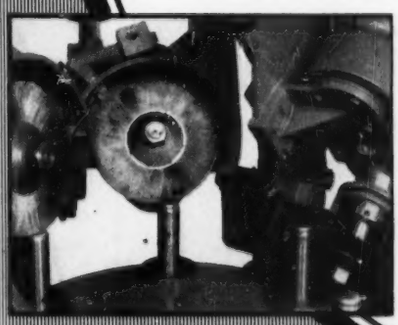
Keep Production Up by Spreading Your Man-Power!



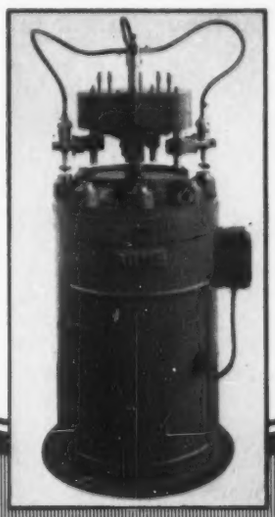
Special Acme Machine for grinding small mechanical parts—2000 per hour.

Special Acme Machine for blending the radius in washers—1200 to 1500 operations per hour, compared to 300 per hour by previous methods.

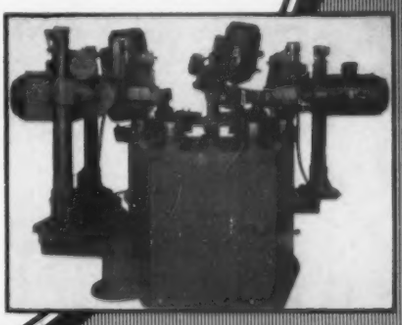
Special Acme Machine for polishing and oiling aircraft parts. Supplants 20 men.



Acme Rotary Machine for polishing, buffing and wire-brushing. Big savings in man hours.



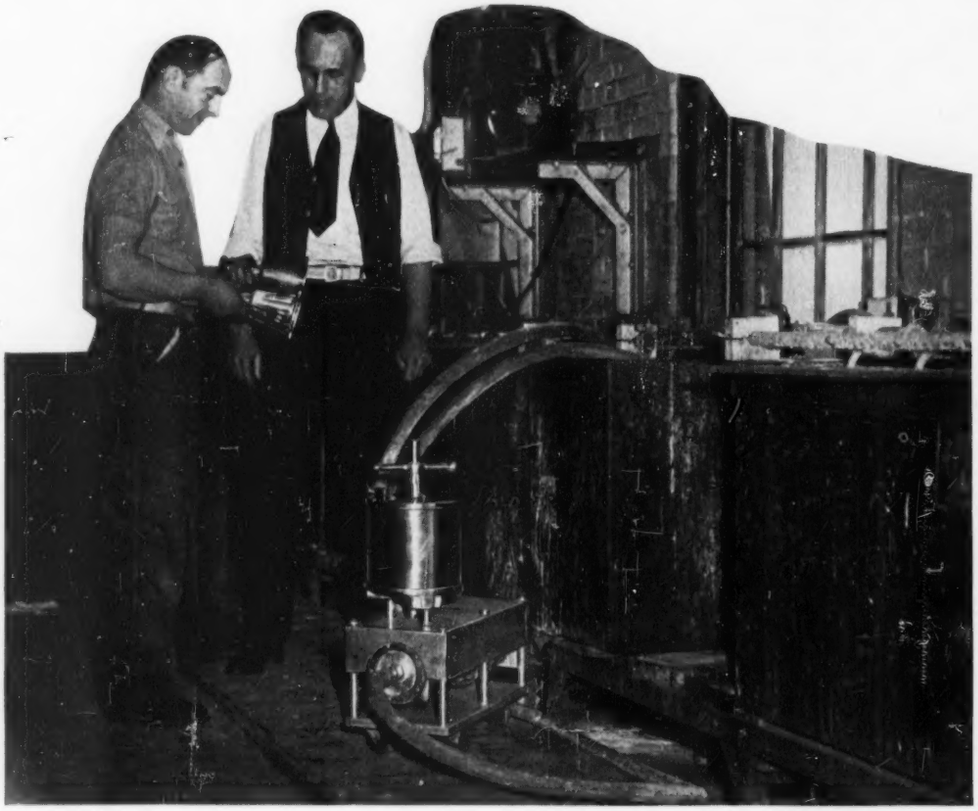
Special Acme Machine for finishing pistons. Eliminates 20 to 25 operators.



ACME *Manufacturing Co.*

1642 HOWARD ST. • DETROIT, MICH.

Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR OVER 25 YEARS



Know what They say about

ALSOP "SEALED DISC" FILTERS

By THEY we mean the fighters on the firing line of production in the plating rooms of American Industry, turning out needed materials for the Navy, Army and other services.

Here is what these men say:—

"Plating solutions for copper, nickel, brass and tin, do a better job if filtered by

ALSOP "SEALED DISC" FILTERS

Dirt, sludge, and impurities in these solutions slow down production, make too many rejects and cause us much trouble. "Sealed Disc" filtration completely cleans our solutions and makes finer finishes, gives us faster plating, and reduces rejects to a minimum."

We have a book on "Sealed Disc" filtration. Would you like it? Write for it. It's free.

ALSOP ENGINEERING CORP.
21 Bright Street **Milldale, Conn.**

MUST YOU CHANGE FROM CADMIUM TO *Zinc?*

If you are one of the plants facing the necessity of changing to zinc plating from your regular Cadmium plating, let Udylite's years of experience guide you.

Udylite's electrochemists will gladly supply you with the information you need.

The Udylite zinc plating process is known throughout the country for its high efficiency and excellent performance.

If shortages and changed specifications dictate that you must find a worthy substitute for Cadmium, we sincerely recommend the Udylite Zinc Process for the job.

Solution, materials and anodes are available for immediate shipment from stock. No special allocation forms are necessary—only your priority certificate with end use.

[Write for Technical Bulletin Z-1. It gives up-to-the-minute information on the change-over from cadmium to zinc.]

THE UDYLITE CORPORATION

1651 E. Grand Blvd., Detroit, Mich.

Cleveland
4408 Carnegie Ave.

Long Island City, N. Y.
11-16, 44th Drive

Chicago
1943 Walnut Street

With your new chemical problems

The conversion of a plant to war production usually creates a need for unfamiliar chemicals and unaccustomed processes . . . when you make the change-over you can secure those chemicals from Harshaw . . . even the common garden variety

this is a good thing to know when you have the thousand and one headaches involved in such a change

more than that, you can count on technical assistance and information, for Harshaw's business is industry-wide, distribution and service facilities nation-wide

inquiries will have executive attention.

Harshaw can probably help

The Harshaw Chemical Co., Cleveland and Principal Cities

Complete Stationary Filter Systems

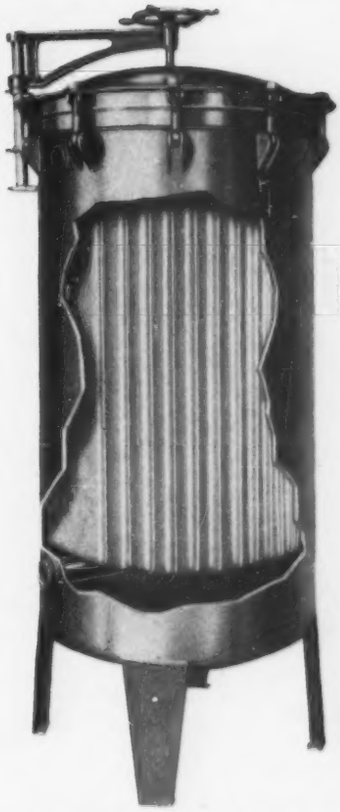


Illustration of Filter Unit

IDEAL CONTINUOUS FILTRATION AND PURIFICATION SYSTEMS FOR PERMANENT USE WITH LARGE INSTALLATIONS OF CYANIDE COPPER & BRASS, HIGH SPEED BRITE COPPER, ROCHELLE COPPER, BRITE ZINC, TIN & OTHER ALKALINE PLATING SOLUTIONS.

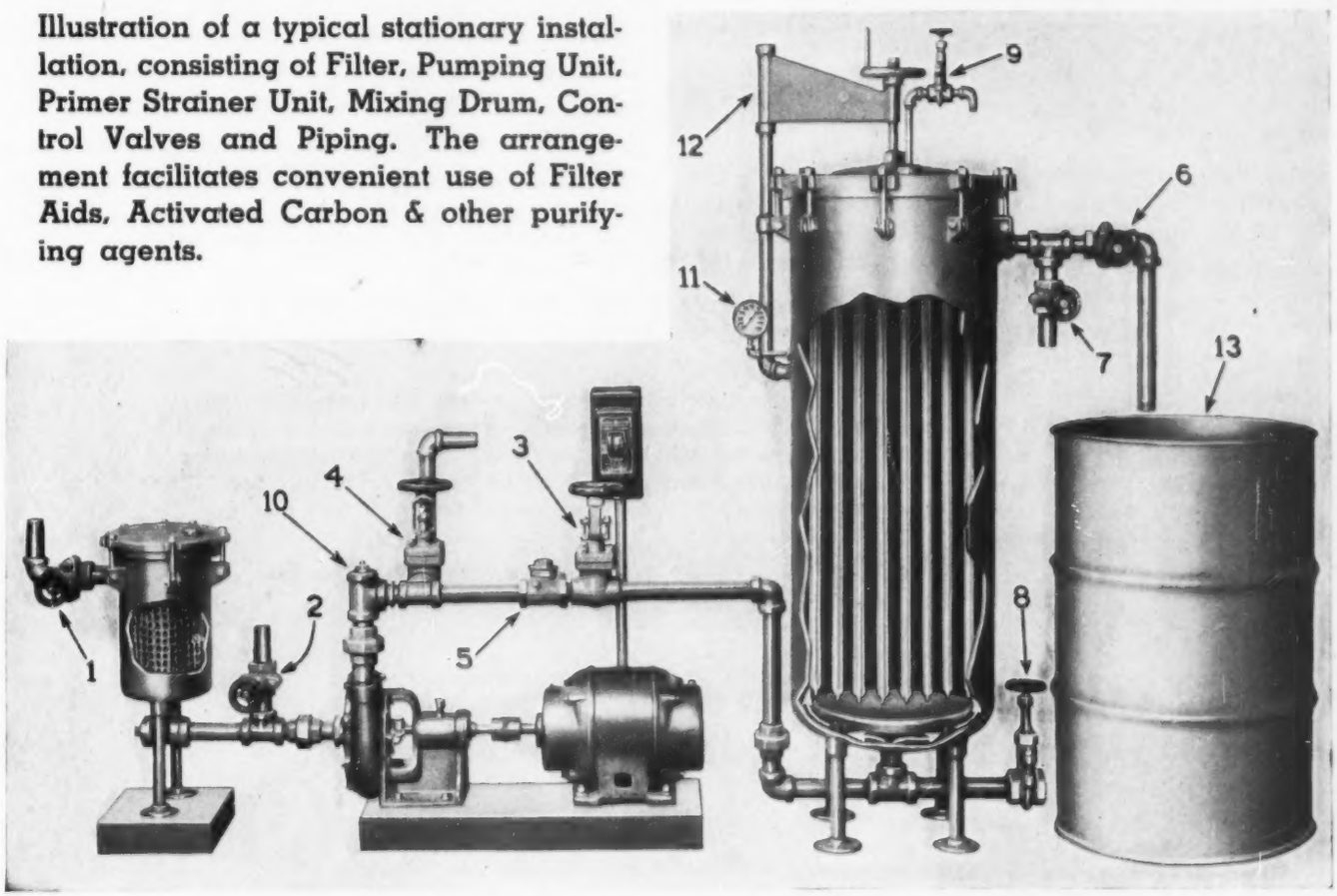
Industrial now offers larger capacity filters having up to 290 Sq. Ft. of Active filtration area, facilitating flow rates to 7200 gallons per hour.

SUPPLIED IN THE FOLLOWING SIZES:

MODELS	CAPACITY G.P.H.	FILTER TANK SIZE	OVER-ALL HEIGHT	NO. OF SCREENS	FILTRATION AREA
I-24	7200	36" x 62"	76"	17	290 sq. ft.
I-30	4600	30" x 62"	76"	14	185 sq. ft.
I-36	3000	24" x 62"	76"	11	120 sq. ft.

Capacities are based on flow rate of 25 G.P.H. for each sq. ft. of filter area, as obtained in filtering high speed Copper Solution. On Zinc & Cadmium, 15 to 20 G.P.H. for each sq. ft. are obtained.

Illustration of a typical stationary installation, consisting of Filter, Pumping Unit, Primer Strainer Unit, Mixing Drum, Control Valves and Piping. The arrangement facilitates convenient use of Filter Aids, Activated Carbon & other purifying agents.



We carry Complete Stocks of Filterbestos, Activated Carbon, Activated Clay (Super-Filtrol, and Chlor-o-cel) and all Grades of Filter Powder Ready for Shipment.

INDUSTRIAL FILTER & PUMP MFG. CO.

3017 WEST CARROLL AVENUE CHICAGO, ILLINOIS

When It Comes to Crossing a Stream

A bridge is better than stepping stones, especially when a heavy load must be carried.

Continuous progress is more satisfactory than intermittent steps.

Likewise continuous filtration of plating solutions with Darco S-51 is surer protection against impurities than periodic filtration—especially with today's heavy schedules.

Many plating plants are filtering continuously with Darco S-51 with complete success even for solutions containing organic addition agents.

Continuous filtration with Darco permits much smaller dosages because, with continuous filtration, impurities are not allowed to build up. Grease, oil, soap, colloidal impurities and decomposition products are removed without interruption. In addition, Darco is always on guard to cope with random impurities that may get into the bath.

Ten cents buys enough Darco to keep 100 gallons of solution clean for a week. Be sure to specify Darco—insist on the trademarked package.

The article, "Physical Removal of Impurities from Plating Solutions," discusses continuous filtration in detail. Write for a copy.

DARCO—Reg. U. S. Pat. Off.

DARCO

This trademark identifies the genuine. Accept no packages without it.

DARCO

CORPORATION

60 East 42nd Street, New York, N. Y.

To Solve Wartime Plating Problems

UNITED CHROMIUM IS DEVOTING ALL ITS EXPERIENCE AND ENGINEERING FACILITIES

These U. C. processes and products can help you!

CHROMIUM PLATING is widely used to extend the life of ordnance parts and machine tool equipment, to salvage worn or rejected parts and tools, and to save countless man-hours in the production of vital war materials.

THE UNICHROME* ALKALINE COPPER PLATING PROCESS makes possible ductile, fine-grained deposits which are utilized wherever they are found to be essential for the fabrication of parts and where they make possible savings of larger weights of critical metals.

THE UNICHROME* ALKALINE STRIPPING BATH is of great assistance in meeting the problem of removing copper from steel. It is exceedingly fast—coatings up to .001" can be removed in 10 minutes or less. The bath is a mildly alkaline, non-toxic solution and does *not* etch the steel base metal.

THE UNITED CHROMIUM PROCESS FOR ANODIC TREATMENT OF ZINC PLATED STEEL giving greatly increased corrosion resistance is now available.

☆ ☆ ☆

UNICHROME* "AIR-DRY" RACK COATING—A coating material for insulating plating racks used in all types of plating and anodizing solutions. Also suitable for protecting dipping baskets and similar equipment.

UNICHROME* "QUICK DRY" STOP-OFF LACQUER 322—An adherent, very fast drying lacquer used in chromium, cyanide copper, and other plating solutions for stopping off areas which are not to be plated. It also stands up in hot, electrolytic alkaline cleaners.

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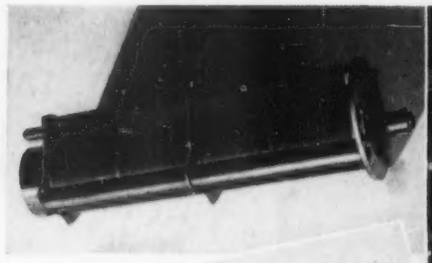

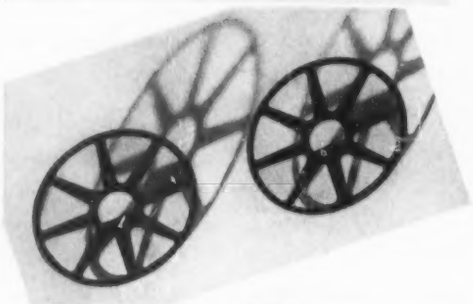

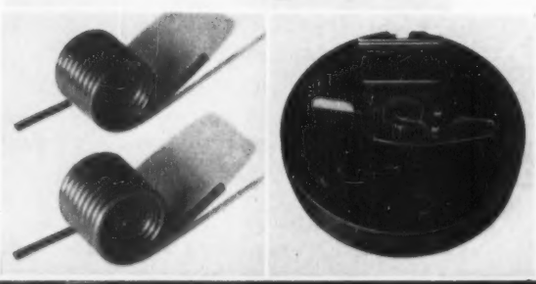

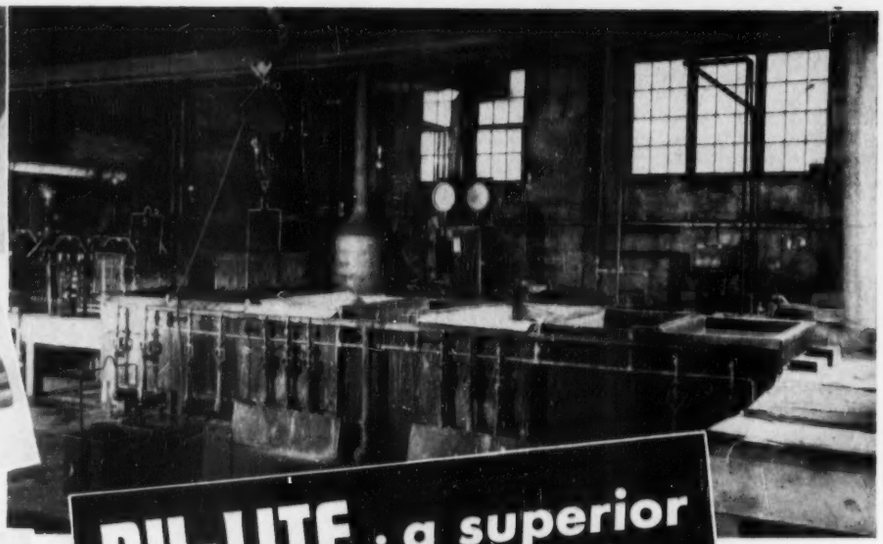

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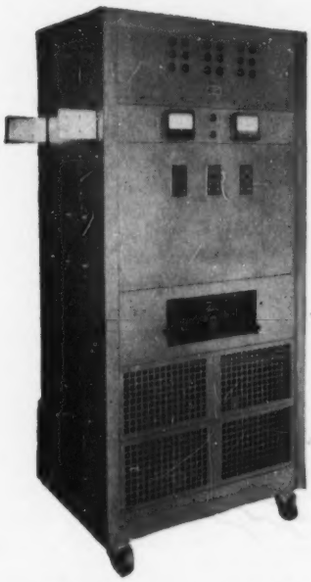

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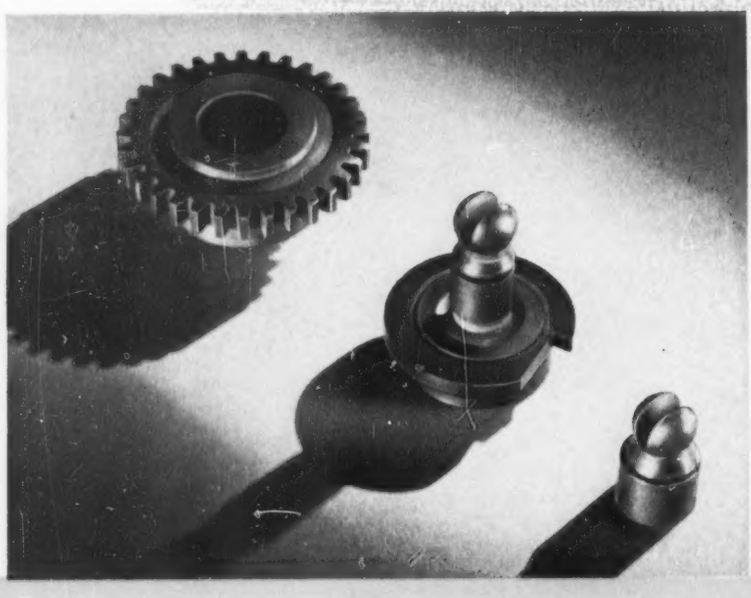
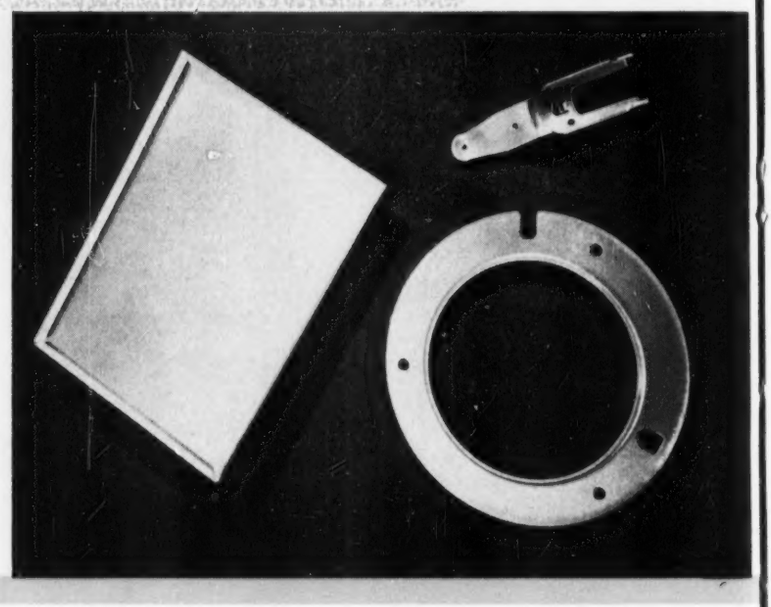


and on these **PLATES, RINGS** *and* **CLIPS**



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VOL. 41, NO. 1 METAL FINISHING JANUARY, 1943
PREPARATION, ELECTROPLATING, COATING

Our Fortieth Anniversary

WITH this January issue *Metal Finishing*, known until June, 1940 as *Metal Industry*, celebrates its fortieth anniversary of publication.

The strong condition in which the paper finds itself on this anniversary, which comes at a time when every enterprise is being subject to the acid test of proving its usefulness or dropping out, indicates the value of the service it is rendering the metal working industry.

Metal Finishing has more subscribers exclusively in the fields of preparation, electroplating and coating today than ever before. In the peacetime, prosperous era of fifteen years ago, as *Metal Industry* the publication had practically the same number of subscribers, but at that time, 50 per cent of them were engaged in the foundry and allied departments. When the great expansion in the plating industry took place as a result of the wide adoption of chromium finishes on automobiles, *Metal Industry* began to concentrate on finishing, until that became its exclusive field and ultimately required a change in name.

Today, finishing with very few exceptions, such as that done on military jewelry, surgical instruments and the like, has changed to coating—simply utilitarian coating for protection against corrosion. These coatings are predominantly either electrodeposited metallic coatings or organic coatings applied to specification.

With the return of peace, we feel that finishing will come back into its own on a larger scale than ever before because of the necessity of applying decorative finishes to aluminum and light metal alloys—the base metals of the future. Thus, *Metal Finishing* looks with confidence to future anniversaries of service to a part of the metal working industry destined to grow.

From One Old-Timer To Another

628 Dovercourt Road,
Toronto, Ontario,
Canada.
December 19th, 1942.

Mr. Thomas A. Trumbour,
Business Manager,
METAL FINISHING,
11 West 42nd St.,
New York City.

Dear Tom:—

Although there are many things for which you deserve congratulations, one impresses me as being worthy of special notice at this time.

I have reference to your connection with the publishing house founded by Mr. Palmer H. Langdon in 1903.

In the January 1911 issue of *Metal Industry*, I find first mention of you as a member of the staff; there you were listed as Cashier. Just how long you held that position I failed to discover.

However, in January 1912 you stepped up to the office of Circulation Manager and more strenuous duties. You did so well in that office the publishers kept you there until 1921 when the sign on your office door was changed to Business Manager.

Today, twenty-one years later you are still "on the job".

Tom, that's a splendid record. I heartily congratulate you.

Your firm has given a truly valuable service to the electroplaters of America and Europe for nearly forty years,—always reliable, informative and up to date.

Furthermore, to you as the only member of the A. E. S. who prior to 1940 attended more A. E. S. conventions than I, as a swell sport, a genial friend with whom I always enjoy renewal of acquaintance, I extend sincere wishes for a Merry Christmas and a Happy and Prosperous New Year.

Faithfully yours,

(signed) Walter S. Barrows.

Technical Developments of 1942

By NATHANIEL HALL AND G. B. HOGABOOM, JR.
Associate Editors—Metal Finishing

THE pressure of war production activities during the past year has been reflected in the relative meagerness of important technical developments in the field of metal finishing. In addition, restrictions on the use of most metals have been a deterrent to further developments in their application. As the year drew to a close, the list of metals available to the metal finisher without any restrictions grew smaller and smaller, until at present, practically the only plating allowed is for war purposes or for essential civilian products.

However, although almost nothing revolutionary was presented to the industry, there was an appreciable number of interesting developments along technical lines which are deserving of consideration.

Theoretical

Electrode potential and overvoltage were the subjects of a number of papers presented last year before various technical societies. The work of Fergeson & Towns[1] supported the previously propounded theory that *cathode polarization potentials* are determined by the activity of atomic hydrogen and hydrogen ions at the electrode-solution interface. They also showed[2] that the *cathode potential both above and below the so-called reversible value,* can be materially altered for a given current density by conditions on the solution side of the electrode-electrolyte interface which influence the rate of diffusion of hydrogen away from or to the interface. Pearson[3] employed *null methods to eliminate IR drops from measurements of electrode potential* in the presence of polarizing currents, furnishing a new tool for studies of corrosion. An *electrical device* was described by Hickling[4] which allows the fixing of the potential of a working electrode at any desired value. This he called a "*potentiostat*". Ferguson & Bandes[5] studied long time *charge and decay curves* for anode, cathode and total cell potentials using cells polarized to different current densities. Breaks in the curves were observed at approximately 1.23 volts and 1.58 volts which are respectively the theoretical potential of the oxygen-hydrogen cell and the observed decomposition potential of water. Kasper[6] offered the fifth in his series of papers on the interrelation of the *theory of the potential and the technical practice* of electrodeposition. We would like to say more but haven't caught up with Dr. Kasper since we got lost in the middle of his second paper while tangling with one of his equations.

Some theoretical and practical *aspects of oxide films* and *passivity* were discussed during the year by Hamilton & Miley[7] and Gulbransen[8]. The latter measured the *thickness of thin oxide films* on iron, stainless steel and chromium iron and his findings of an oxide film thickness of 78 Å on iron passivated by immersion in 70% nitric acid, as compared with a film thickness of only 29 Å for iron oxide formed by exposure to air may offer an explanation for the passivating action of nitric acid on iron. Rohrman[9] proposed that for *passivity,* films must satisfy three requirements — they must be insoluble, adherent and continuous.

Nielsen & Holt[10] presented evidence for the presence of a *cathode film found in an acid tungstate solution.* This film was found to prevent subsequent nickel deposition. Kushner[11] offered a mathematical derivation of the *drag-in and drag-out effects* in plating solutions which appeared somewhat familiar, although we will admit that all equations with more than two variables look alike to us. Landau[12] examined the experimental data available with a view toward clarifying the *mechanism of alloy corrosion* and Hendricks[13] reviewed the theories of *brightener action,* proposing the theory himself that brightening action is brought about by an adsorbed organic material of the acid inhibited type which may be formed by cathodic reduction and which may be a colloid working in conjunction with an inorganic colloid, the latter being a precipitated metal salt.

Anodizing and Corrosion Prevention

As would be expected, in view of the enormously increased utilization of corrodable metals such as aluminum, magnesium and iron for war purposes where corrosion resistance rather than appearance is the main requirement of a finish, the subjects of anodizing and corrosion prevention predominated in the technical and patent literature pertaining to finishing.

Edwards[14] discussed most of the *anodic and surface-conversion coatings* on aluminum, magnesium, zinc and iron and Brown & Mears[15] presented before The Electrochemical Society a study of *cathodic protection* as a means of limiting or preventing corrosion. They pointed out that in special cases the cathode may be attacked rather than protected by this method, giving as an example the activity of aluminum in solutions containing sodium chloride where the aluminum is attacked by the sodium hydroxide liberated at the cathode. This subject was also treated by Fahrney & Mears[16] who, in discussing methods which have proved beneficial such as *cathodic protection* of aluminum with zinc, pointed out that zinc is effective only in neutral or acid solutions or occasionally in some weakly alkaline solutions in which zinc is anodic to aluminum.

The most efficient operating conditions for the *chromic acid anodizing bath* for aluminum were determined by Tarr, Darrin & Tubbs[17]. The authors suggested operation at 0.85 pH in a bath containing 10% free and combined chromic acid and slightly higher in a 5% bath, giving a control method involving determination of the Baume and pH. Hartford[18] in a discussion of the *chemistry of the bath* and its application to control gave formulas for draw-off and chromic acid additions. Our comparison of these methods of control gave results of the same order of magnitude but the actual results may be somewhat higher or

lower for different solution conditions. The same author[19] found that *measurements of the pH of anodizing baths* and similar solutions indicate unusually high hydrogen ion activity, which further increased abnormally as the concentration of trivalent or hexavalent chromium is increased. He suggested that this effect is due to activity effects arising from the high ionic strength and asymmetric valence type of the solutions.

Complete details on the *practical operation of chromic acid anodizing baths* were given by Tubbs[20] and Finnie[21] while Loven[22] showed how the *life of the bath* was increased from about 5-6 weeks to 12-15 weeks by substituting an insulating lattice of synthetic material for the usual hardwood lattice which reacted with the chromic acid. Bogle[23] pointed out that the *use of rectifiers as power sources* for anodizing had an important advantage in that units could be coupled in series-parallel to get the required voltage and amperage so that if not needed for anodizing, they could be dismantled and used individually at low voltage for plating purposes. Stressing of samples of 53ST aluminum alloy anodized by various processes by Hill & Mason[24] showed that the *oxide coatings*, in spite of their mineral-like hardness are surprisingly elastic. Sealing in water or in dichromate solution was found to reduce the brittleness slightly.

A number of new developments were recorded in the field of surface-conversion coatings. A new method of *protecting aluminum* was patented by Filbert[25] involving treatment with a hot solution of carbonate and chromate and subsequent exposure to the action of steam at pressures of from 50 to 150 lb. A *protective film* can be formed on metals such as iron, steel, zinc and aluminum, according to patents granted to Thompson[26, 27] by treating with a hot acid solution containing fluosilicate and an oxidizing agent, Thompson & Goodspeed[28] were also issued a patent on the novel idea of applying a corrosion preventive solution to an article *after* the priming coat instead of *before* as is customary.

Various *surface treatments for magnesium* were discussed in great detail by both ApRoberts[29] and DeLong & Gross[30]. Buzzard[31] patented a process for magnesium in which the Chrome Pickle was followed by treatment with a solution of sodium dichromate and magnesium fluoride, while DeLong[32] received a patent on a somewhat similar treatment involving a solution of a fluoride and a strong mineral acid. Buzzard also patented an *anodizing process for magnesium*[33], using a solution of phosphate and chromate and then subjecting the anodized article to a solution containing manganese sulfate and a chromate.

Protection of iron and steel was the subject of an article by Young[34] who described *black finishes* and *phosphate treatments* for metals, and by Cosman[35] who described a rather interesting method of *chromatizing steel*, which is analogous to sherardizing except that chromium is used instead of zinc, involving exposure of the steel to vapors of chromous chloride. The surface was found to contain over 30% chromium and was highly corrosion-resistant. *Calorizing ferrous metals* by applying a paint consisting of a vehicle and granular aluminum and heating to about 600-700° C. was patented by Adams[36]. *Phosphate coatings for iron, steel, zinc and cadmium* were the subject of patents granted to Remy[37], Darsey[38] and Clifford & Adams[39]. The use of *ferric oxalate solutions* was patented by Tanner[40]. A somewhat extraordinary patent was granted to Hardoen[41] on a *process for rustproofing iron and steel* by treating with direct current in a solution of an alkali hydroxide using an anode of copper, chromium, tin, zinc, manganese, nickel or lead, whereby there is claimed to be deposited on the articles a "magnetite analogue of the anode metal". In a patent granted to MacKay[42], it was claimed that articles of iron, copper, or their alloys could be coated by treatment with a fused mixture of alkali metal hydroxide, phosphate and an oxidizing agent followed by a sealing treatment, and in a patent issued to Werntz[43] a *rustproofing composition* containing an acid maleate or phthalate was claimed.

A patent covering a *phosphate treatment for copper and its alloys* was issued to Lodeesen[44], the solution consisting of an acid phosphate and an oxidizing agent. A method of providing a *protective coating on zinc and cadmium* using a solution of a chromate and mineral acid, followed by treatment with a hot solution of alkali and dichromate was claimed by Lum[45].

The use of *phosphates* for the formation of corrosion resistant films claimed the attention of most investigators engaged in this field. In addition to those mentioned above, patents were issued to Tanner & Lodeesen[46] for the use of an *accelerating metal* with the acid phosphate which was allowed to dry on the work, to Tanner & Harris[47] for a *solution of phosphoric and chromic acids* which were used in the same manner, to Boyle & Sclar[48] for the *addition of a wetting agent* of the organic phosphates and phosphatides. *Acceleration of the phosphate treatment* by the addition of hydroxylamine and of a quinone were the subjects of patents by Clifford & Adams[49] and Gibson[50] respectively.

The use of other coating materials was patented by Tanner[51] employing *hexavalent chromium and pentavalent arsenic compounds* and by Thompson[52] employing a *coating of oxides and sulfides* of the basis metal and another metal below magnesium in the electromotive series. Rogers[53] claimed a process for applying a *film of lanolin* by adding the material to trichlorethylene in a degreaser and after immersing the parts in the hot liquid, removing them rapidly through the vapor phase.

Polishing

In contrast to 1941 and in spite of the radically decreased opportunities for commercial application, *electrolytic polishing* of metals was given more attention in both the technical and patent literature last year than *mechanical polishing*. On the latter subject Gallaher[54] pointed out that when using *coated abrasives* for removing metals, relatively coarse abrasives at high speeds give a surprisingly smooth finish. Lux & Berdick[55] studied the *effect of the polishing of basis metals on the protective value of plated coatings*. Their results to date indicate that polishing the steel does not have as pronounced an effect on the protective value of the coatings as has been generally supposed. The authors joined the long list of investigators who have found that the various porosity tests are not very reproducible or significant and are now eligible for membership in the S.S.S.S.S.S. (Scientific Society for the Suppression of Salt Spray Specifications).

On the subject of *electrolytic polishing of steel*, Young & Brytczuk[56] determined the optimum conditions for the operation of the 60% phosphoric acid—20% sulfuric acid—20% water solution which was found best for commercial polishing. At 5 amp./sq.in. and a temperature of below 80° C. they obtained a reflectivity of 32% that of a silver mirror in 3 minutes. *Polishing of steel*, but from the standpoint of suitability for metallographic work, was studied by Imboden & Sibley[57] who discussed the various *theories of electropolishing* and gave the details of five solutions which were found satisfactory for steel. The use of a solution of *pyrophosphoric acid in a non-aqueous solvent* such as alcohol was claimed in a patent granted to Delaplace & Bechard[58] but this process will probably be only a laboratory curiosity until such time as pyrophosphoric acid can be produced in quantity at a cost comparable with that of other materials which can be used.

An interesting paper on the *electropolishing of silver* was presented by Gilbertson & Fortner[59] in which they claimed good results were obtained in cyanide plating solutions under closely controlled conditions. Faust received two *patents on electrolytic polishing*, one on the use of a solution of sulfuric and arsenic acids[60] and the other on the use of arsenic acid plus another acid from the group consisting of phosphoric acid and chromic acid[61] which could be used for a number of metals, such as copper, brass, stainless steel and aluminum.

Cleaning

A *method of evaluating metal cleaning compounds was* developed by Morgan & Lankler[62] which utilized the *fluorescent properties of mineral oil* under ultra-violet radiation. Photographic records are made and can be used to determine quantitatively on a surface the amount of oil before and after cleaning. Mitchell[63] discussed the use of *emulsifiable solvents* as substitutes for chlorinated solvents which are under government restrictions, and Bolton[64] presented a study of the *effect of silicates, phosphates, borax, soda ash and caustic soda* on oleate and stearate soap requirements for sudsing in hard water. His investigation showed that the more alkaline silicates, caustic soda and the phosphates gave the greatest soap economy. Caustic soda and soda ash produced large adherent soap curds which were difficult to disperse while any curds developed with the silicates and phosphates were very minute and so well dispersed that they were apparent only as turbidity. These

findings should be of great interest to ball burnishers and others who use soaps in hard water.

Lawrence discussed the importance of *cleaning in the production of proper welds*[65], and in connection with *electrolytic cleaning* the subject was reviewed by Hanley[66] from the standpoint of *hydrogen embrittlement and its inhibition*. Sizelove[67] received a patent on an *electrode for electrocleaning* comprising two superposed interconnecting grills. Leever & Bogle[68] claimed that a rectifier with two bridges insulated from each other could be used to feed two cleaning tanks with opposite polarity *without stray current effects* even though the tanks were connected electrically. Passivity, the bane of bright nickel platers, can be relieved before applying chromium or other deposits according to a patent issued to Harshaw & Long[69] by treating the nickel plated article as *cathode in a solution of sodium cyanide*. This treatment is specified for bright nickel deposits which contain a minor amount of a codeposited metal such as selenium or tellurium.

No attack on tin or spangle formation was claimed for an *alkaline cleaner* containing a small amount of chromate salt and an alkali metal fluosilicate according to a patent issued to Metziger & Long[70] and a *cleaner for iron and steel, to be used before phosphate treatment*, and containing in addition to the usual alkali, an emulsified material consisting of organic materials such as dead oil, anthracene oil, creosote oil, pine oil and high flash coal tar naphtha, was patented by Romig[71].

Pickling

Perusal of the technical literature discloses very little on the subject of pickling. The studies of Uhlig & Wallace[72] showed that *passivity of* 18-8 *stainless steel* is probably due not to a protective oxide film but to preferential solution of anodic areas forming an electrochemically homogeneous surface. Evidence of this view is the passivating action of hydrochloric acid containing an inhibitor such as quinolin ethiodide which will dissolve an oxide film.

Three patents were issued on the *pickling of magnesium*, one to DeLong on the use of carboxylic acid solutions[73], and the other two to Miller[74] for sulfuric acid solutions containing aliphatic acids such as oxalic and citric and sulfuric acid solutions containing aromatic compounds such as phenol which would not etch the magnesium surface. A pickle for aluminum which produces *a white matte finish* was patented by Slunder[75] and contained hydrofluoric acid and ferric chloride. A hot solution of sodium cyanide and caustic soda was claimed to remove *scale and oxides from copper-beryllium* alloys by Kawecki & Martin[76] and a solution of sulfuric acid and ferric sulfate was patented by Dockray[77] for the *pickling of steel*.

The problem of *pickling waste elimination* is still with us and effective disposal and recovery of possible value will probably continue to intrigue plant chemists for many years to come. Van Antwerpen[78] utilized pickle liquor by *treating it with slaked lime* to form calcium sulfate and ferrous hydroxide which was filtered out and formed into building materials. Gehm[79] treated the liquors with *sodium silicate and soda ash* to produce high purity Glauber's salt, finding that the iron residue was easily filterable and free of sulfur, thus offering possibilities of iron recovery. He also studied another method in which the *free acid was neutralized with iron* and the sulfate converted to chloride by adding calcium chloride. The iron chloride could then be converted to ferric chloride with chlorine while the precipitated calcium sulfate has possibilities for use as a building material. Marek[80] patented a process in which the *pickle liquor is evaporated* to precipitate ferrous sulfate which is roasted to oxidize the iron. The roast is then treated with ammonia gas and water to produce ammonium sulfate and iron oxide.

Coatings

General

The practical possibilities and some applications of *bipolar electrodes* to obtain better distribution of deposits, including sketches of some plating racks making use of the principle, were presented by Savage[81] in a paper which should be studied and remembered by all platers. George[82] discussed the *different types of agitation* used in plating solutions and their effects on the character of the deposits. The plating processes used in the *aircraft industry*, which accounts for a good portion of the plating done today, were described by Janssen[83] and Linsley[84] described the use of *metal spraying* for aircraft engine components with aluminum, employing an automatic machine for the purpose.

Keskulla & Edwards[85] gave details of the various methods of *finishing aluminum die castings*, Domm[86] patented a process for *producing rubber adherence to metals* by applying a deposit of zinc, cadmium, lead or tin followed by a very thin nickel or cobalt deposit between the rubber and the metal article, and Machu[87] listed the procedures for *removing deposits and recovering the removed metals*.

Hydrogen embrittlement and its elimination was the subject of a patent issued to McElhaney[88]. Raskin outlined the causes of *possible losses in the cleaning, pickling and plating cycle*[89] giving methods for their elimination. LoPresti[90] gave figures for *comparison between old and new methods* in a paper on motion and time study in electroplating, proving only that figures may be used to prove anything, especially when a drying oven is placed about 32 ft. from the unracking table for no reason at all in a diagram which indicates the distance could have been about 4 ft. were it not for the purpose of proving a point. ApRoberts[91] discussed the *chemistry of water softening* and the *contamination of plating solutions* due to the materials which are often present in water supplies.

Cadmium-Indium-Iron-Lead-Alloys

Mikhalev[92] investigated the mechanism by which *colloids* such as dextrin *modify the crystal structure of cadmium and zinc deposits* from the sulfate baths. He found that deposition proceeded at a higher negative potential and that the deposits have a fine crystalline structure. According to Soderberg[93], outdoor tests in corrosive industrial atmospheres showed that *chromic acid bright dips improved the corrosion resistance of cadmium plate* and recommended a 3-second bright dip in order to remove a minimum of deposit, which is quite a trick, especially in automatic conveyors or with bulk work in baskets. Fusco & Woldman[94] discussed the *properties, maintenance and control of cadmium plating solutions* together with the factors involved in automatic plating, and Hodecker[95] gave the procedures he used for *cadmium plating parts for ignition harnesses and radio shielding for aircraft engines*. That more care should be exercised in the application of cadmium plating to objects which might come in contact with foods, was shown by the case histories offered by Frant & Kleeman[96] and by Calvery[97]. The *symptoms and sources of cadmium food poisoning* were detailed, showing that practically all cases were due to cadmium plated food containers and ice cube trays. An *immersion cadmium bath* was patented by Reuter[98] involving a solution of cadmium salt and a large amount of free alkali.

The properties of *indium and its uses*, especially for bearings and reflectors and the plating and diffusion of the metal were discussed in retail by Ludwick[99] and a novel *non-cyanide indium bath* containing dextrose and sodium hydroxide was patented by Smart[100].

The banning of nickel facing for stereotypes brought to life the use of *iron* for the purpose and this subject was covered by Blum[101] and Blum & Lamb[102] who advised the use of the ferrous ammonium sulfate bath and a new ferrous chloride-potassium chloride solution in order to conserve a great part of the nickel and copper ordinarily used. Iron produced by electrodeposition *from a solution containing a suitable silicate* and capable of maintaining its fine grained structure when heated above the upper critical was claimed by Young[103].

A *substitute for terne plate* is indicated in an alloy patented by Smith[104] and containing tin, zinc and antimony in small amounts in addition to the lead, which is the main constituent. New *specifications*[105] were also issued for *hot-dipped lead coatings* on iron and steel hardware calling for at least 30 milligrams per square inch which is equivalent to a thickness of about 0.00016".

The *codeposition of gold-copper alloys* from a theoretical standpoint was studied by Dole[106] who found that increase in the current density above a certain value failed to increase further the gold plating current. The copper plating current seemed to be controlled both by diffusion and the rate of ionization of the complex cyanide while the gold plating current seemed to be controlled only by the rate of diffusion. Gernes & Montillon[107] investigated the *deposition of brass from thiosulfate solutions* containing sodium thiosulfate, copper, zinc and ammonium chlorides and determined the conditions for the deposition of different compositions of brass. Young[108] described the applications and equipment for production of *white brass and black and gray nickel deposits*. Tungsten alloys were

studied by Holt & Nielsen[109] who found that under careful control *deposits of nickel containing from 5 to 10% tungsten were obtainable* from a Watts nickel solution modified by additions of sodium tungstate, and by Holt and Black[110] who deposited *iron-tungsten alloys* from a bath containing ferrous ammonium sulfate to which was added sodium tungstate.

Chromium

The chromium plating solution consisting of *chromic and chloracetic acids*, with which a number of platers have been familiar for years, was patented by Murray[111]. His claims covered a solution containing 36 oz./gal. of chromic acid and from 2 to 9 oz./gal. of monochloracetic acid operated at 90-130° F. with a current density of 111 amp./sq.ft. Efficiencies up to 37% are obtainable according to the patent.

Another process for which a patent has been applied by Lundbye and which was described by Lloyd[112] involves *heating of chromium plated small cutting tools in an oil bath* for 1 hr. at 350° F. to relieve hydrogen embrittlement. He states in the first paragraph that chromium plating of small tools has been tried many times and has never proved entirely successful until the Lundbye process was developed. A visit to some plants doing hard chromium plating would have corrected this misapprehension on the part of the author.

Logozzo[113] showed, with some excellent photomicrographs reproduced elsewhere in this issue of *Metal Finishing*, the *effect of the nature of the basis metal surface and the surface preparation on the grain size of the deposit* and pointed out that anodic treatment before plating and baking after plating are essential in order to minimize the effects of hydrogen. The *increased wear possible through chromium plating* was discussed by Van Der Horst[114] who stated that plating of cylinder bores for Diesel engines decreased the wear to about 1/7 that of cast iron in one case and even more in others, and by Fletcher[115] who described a number of *applications of hard chromium plating*. Both authors presented actual figures on wear tests showing the improved performance of chromium plated parts over unplated parts. The methods of *controlling the temperature* of chromium plating baths were described by Lumpkin[116] while the *advantages of rectifiers* for hard chromium plating were pointed out by Bogle[117].

Probably the only original work of the past year on relatively thin deposits of chromium was the investigation by Eyre[118] of *resistance to exposure of chromium deposited directly over brass* as against chromium with an intermediate nickel deposit on plumbing fixtures, the results of which indicated that even a light coating of nickel has a marked effect on the corrosion resistance. Chromium direct on high copper cast brass gave a reasonably good coating but on high zinc wrought brass, annealing after chromium plating was found desirable for improved adherence, probably because it relieved the stresses in the base metal. High zinc wrought brasses were found to stand up fairly well if copper plated before chromium. Although the chromium deposit showed cracks, its adherence did not seem to be lessened.

Copper-Gold

The most interesting copper plating development of the year was the *bright acid copper bath* of Clifton & Phillips[119] employing *thiourea and molasses* as brightening agents. To avoid deposition of copper by cementation it is still necessary to precede the bright plating by a cyanide copper strike to cover steel parts; in addition the deposit becomes unsatisfactory when the temperature of the solution rises, so that some form of cooling or refrigeration is required in warm weather. However, until the use of copper for automobile hardware was prohibited, this solution was used in several large installations with great success.

Another *bright copper plating bath* was presented, although of the hot cyanide type, in a patent issued to Wernlund & Bair[120]. Their bath consisted of a very concentrated solution of copper and sodium cyanides to which was added as brightening agents caustic soda, sodium thiocyanate and a carbohydrate such as starch.

Other articles on the subject were offered by Clark[121] on the procedure used for *copper plating phonograph matrices* back in 1919, and by Thompson [122] on the use of *copper for selective carburizing*. The latter author found that the ability of the deposit to withstand penetration by carbon monoxide was not a function of the thickness of the deposit except in so far as thicker deposits are less porous. Acid copper deposits must be thicker, he stated, than cyanide copper deposits for the same protection, this being due apparently to the greater porosity of the deposits from the acid copper solution.

Electrolytes containing nitric acid have given trouble to the electrorefiner because they cause corrosion of ordinary lead anodes. A new *insoluble anode* comprising an alloy of lead plus antimony and silver was patented for this application by Campbell[123].

Except for a patent on an apparatus for the *recovery of gold from rinse waters* by passing through containers connected in series and filled with zinc[124], Kushner held the field all to himself with his monthly series of articles on *gold plating* which is now in its third year. With the help of occasional lapses into subjects which have very little connection with the title of his articles, such as aluminum anodizing, he is fast approaching the record, unsurpassed in the metal finishing literature so far as we know, of Beaver whose informative series of papers on barrel finishing have been of much help to those practicing the art. Among the phases of gold plating discussed by Kushner[125] were the manufacture of *gold leaf by deposition, gold plating of wire for braid* and *bright stripping*.

Nickel

The development of a process for producing *adherent deposits of nickel on magnesium* was one of the highlights of the year, and the details were presented by Loose[126] who found that a fluoride dip followed by deposition of the nickel from a borofluoride bath resulted in good adherence. The deposits were not recommended for moist, corrosive exposure conditions because of corrosion due to the nickel-magnesium couple at the pores. An interesting phenomenon was the discovery by Watts[127] that at very high current densities in a hot solution of nickel sulfate and sodium sulfate good *deposits of nickel* were obtained on the *back of a cathode* but none on the *front*. This was attributed to the creation of a thick alkaline film on the front as a result of the high current density and high sodium ion concentration of the solution. The *distribution of the deposit* was also discussed by Halls[128] who considered articles of irregular shape with the help of diagrams and tables. Because of the large variations encountered over the surface he recommended that spot tests should only be used for minimum thickness determinations and that stripping tests should be resorted to for average thickness figures.

The optimum conditions for the *deposition of nickel on iron* were investigated by Solanki & Singh[129] who found that the efficiency rises with increase in current density up to a certain point and then drops, due to depletion of metal in the cathode film. Tucker[130] ran a series of test on the *Watts type nickel solution*. His experimental data showed that the nickel content was relatively unimportant except that higher current densities could be used with higher metal contents, that the sulfate ion had no significant effect and that the chloride increased the hardness and decreased the crystal size. It was also shown that the boric acid content was not critical and had the effect of reduction in crystal size. Unlike the chloride, however, this reduction was without a corresponding increase in hardness.

By employing a Watts solution but *substituting ammonium chloride for the nickel chloride*, Wesley & Roehl[131] found a definite improvement in the deposits of *hard nickel*, which were suitable for industrial and engineering applications, in that there were no laminations in the deposit and the solution was well buffered and easily controlled. Romanoff[132] determined the *fabricating qualities* of such deposits with the use of a stiffness tester and an Ericksen cup tester by preparing a set of curves to compare stiffness with tensile strength.

Bright nickel baths were patented by Lind, Harshaw & Long using various organic brightening agents[133, 134, 135], and by Baker[136] *using sodium formate*. A *semi-bright nickel* was claimed for a solution of nickel chloride and boric acid by Wesley & Carey[137]. Wesley along with Rollason was also the inventor of a process for *nickel coating iron*[138] which consisted of applying a varnish containing nickel flakes and heating at 1400°-2100° F. in a non-oxidizing atmosphere, followed by cold rolling and reheating. Three patents were granted in connection with *nickel anodes*. One by Hull[139] involved heating the anode to about 800° C. and quenching it in sulfuric acid, the resulting anode requiring no deskinning.

Geiger[140] claimed a process of *extruding cast nickel ingots at elevated temperatures* into anodes which corroded as uniformly as rolled anodes. Bieber & Tschop[141] were granted a patent on an improved nickel anode containing *specified amounts of carbon, sulfur, silicon, magnesium, copper, manganese and iron* which was claimed to be non-sludging.

As a result of the scarcity of nickel and the restrictions placed on nickel plating in consequence, the *recovery of nickel from plating solutions* which were standing idle was given some study by a number of investigators. Pinner[142] tried reclaiming the nickel as an alloy with iron by *deposition* with iron anodes. About 85% of the nickel could be recovered economically and the process has the advantage of absence of chlorine evolution and obviation of additions of alkali to maintain the pH at the point of optimum efficiency, both of which are encountered with the use of carbon anodes. The matter was also studied by Wesley & Roehl[143] whose tests were run concurrently with those of Pinner and who, in addition, investigated the *precipitation of nickel by cementing out* on iron powder with various types of agitation and the *deposition of nickel using insoluble anodes.* Plating with insoluble anodes was found to give a very high recovery of nickel in pure form. Their results with iron anodes were comparable with those of Pinner.

Silver

For a while during the early part of last year it seemed that silver, in spite of its cost and sensitivity to tarnish, would be the answer to shortages of coating metals for non-defense purposes. However, those were the days when basis metals were available to be plated on. Reams of copy were published with suggestions and procedures for *converting plating plants,* especially those which had been using nickel and copper. Bregman[144] demonstrated that both the cost of conversion and of operation were not out of line, especially since the silver used would be only a minor item in the cost of production of most articles and presented figures to prove his points. He also discussed the use of *lead and tin undercoats for silver* to increase the corrosion resistance when deposited on steel[145], claiming that the saving of silver would offset the cost of the extra plating operation. A general summary of the *silver plating process* was offered by Mattacotti[146] and Young[147] made the interesting suggestion that *electrodeposited iron* be used as an undercoat for silver since the silver would then tend to deposit in a pore free condition.

Thin, adherent, decorative *deposits of silver were produced on magnesium* in a boric acid-cyanide solution, after proper pretreatment of the base metal by Bowen & Gilbertson[148]. Gilbertson & Crosby[149] studied *silver deposits produced by brush plating* and found that lamellar microcrystalline deposits were produced, which they showed by photomicrographs. They also showed that the low porosity of brush deposits may be due to the lack of channels through the deposit to the base metal. The same authors determined by photomicrographic examination[150] that the *adherence of electrodeposited silver to steel* is dependent on factors other than mechanical interlocking. It appeared that the most important factor was the intra-atomic bond between closely associated crystals of ferrite and silver and this condition was favored by a strike. They found that the current must be on before immersion in the strike, which is understandable in view of their use of only 2.40 oz./gal. of potassium cyanide. Probably if they had used the usual steel strike, which has a much higher cyanide content—from 8 to 12 oz./gal.—they would not have required this initial electrical contact, as many flatware platers can testify. LoPresti[151] stated that a *dip in phosphoric acid* followed by a single strike produced a remarkably adherent deposit of silver on steel, but although his article was entitled "Silver Plating Steel over a Phosphate Coating", no evidence was offered to substantiate the presence of a phosphate coating.

Production of *ceramic coatings on electrodeposited silver* was discussed by Helmle[152]. A clear glass finish was applied over silver which was deposited from a Wood's type solution under very closely controlled conditions. The glass was applied as a suspension of the powder in water, with gum present to hold it in suspension. It was then fired at 1475° F. *Silver plating for bearings* and the deposition of silver, lead and indium followed by heating to diffuse the coatings and to form bearing surfaces which were not attacked readily by hot lubricating oils, were the subjects of a paper by Bregman[153].

Tin

The loss of a large part of our sources of tin to the enemy necessitated strict curtailment of this metal. Previous investigations had indicated that great economy was possible in the *substitution of electrodeposition for hot dipping* for the production of tin plate and the industry is being converted to take advantage of this saving. It was shown that a deposit of as little as 0.00003" was satisfactory for fabricating practically all types of cans[154].

In order to reduce the porosity of such thin deposits it is desirable to have the smoothest possible coating which is obtained by adding suitable *brighteners* to the bath, such as those patented by Schlotter[155] comprising mixtures of organic tin sulfonates and dispersed resins such as wood tars, phenolic and cresylic resins and the like. The *melting and flowing* of the deposit were covered by Erbe[156] who discussed the *methods and equipment* used for *continuously plating steel strip* and for flowing of the deposit. Stoltz[157] described the use of *high frequency induction heating* for flowing tin deposits on strip and Hopper[158] patented a process in which the tin is deposited first from an alkaline bath and then from an acid bath and is flowed by immersing the coated strip in a bath of hot fatty acid containing non-oxidizing oil. Fink[180] claimed the *brightening of tin deposits* by immersion in a hot oil containing uncombined carboxylic acid, at a temperature high enough to flow the deposit. *A hot tinning process,* in which the salient features were anodic etching of the strip in nitric acid and wiping of the tin coating under pressure, was the subject of a patent issued to Beckwith[159].

A study was made of the *stannate bath* by Sternfels & Lowenheim[160] using *potassium* instead of *sodium* salts. The advantages of the potassium bath were found to be higher solubility and positive temperature-solubility relationship, higher conductivity, better stability and wider current density range. The authors obtained a cathode efficiency of 82% at 150 amp./sq.ft. as against a maximum current density of 60 amp./sq.ft. for the sodium bath. They were also able to get good deposits at 1,000 amp./sq. ft. in the potassium bath.

The *sodium stannate bath* was covered very completely by Baier[161] including all phases of the preparation, use and control of the solution. Mathers & Johnson[162] investigated the *ammonium stannous oxalate bath* and found glue, after hydrolysis by boiling, to be as good an addition agent as peptone. Degeneration of the bath was determined to be due to oxidation of the stannous ions to the stannic state and regeneration was accomplished by adding some spongy or finely divided metallic tin and boiling to reduce the stannic ions.

An *immersion tin bath for copper alloys* was patented by Bradley[163] who claimed a solution containing divalent tin and a rather large amount of thiocarbamide. Finnie[164] stated that a deposit of 0.00018" of tin could be produced *on aluminum* by immersion for 4 minutes in a hot solution containing 6 oz./gal. of sodium stannate.

Zinc

High speed *acid zinc plating of wire* using the Bethanizing process was described by Winkler[165]. In an article on zinc plating of metals which was mainly a recapitulation Finnie[166] claimed that the *corrosion resistance of zinc deposits* would be increased by immersing for from 5 to 20 seconds in a solution containing 3.5 oz./gal. of sodium dichromate and 1.8 oz./gal. of sulfuric acid at room temperature. It was claimed, in a patent granted to Hull[167], that zinc could be deposited *on metals such as cast and malleable iron,* on which the hydrogen overvoltage is so low as to interfere with the deposition, by first immersing the iron in a hot solution of sodium cyanide for not less than 5 minutes.

An addition agent for *brightening cyanide zinc baths,* prepared by reacting materials consisting of a phenol-aldehyde condensation product and a soluble metal salt was patented by Hoffman[168]. A *zinc bath free from cyanide* and comprising essentially sodium zincate and glycollic acid or one of its salts was the subject of a patent issued to Ruebensaal[169].

Various phases of *hot dip galvanizing* were covered by Imhoff who showed how the *time of immersion* of articles for obtaining the best zinc coatings could be determined[170]. In his study of the *efficiency of the hot dip galvanizing furnace*[171] he made tests on a full size pot holding 21 tons of zinc and found that a minimum of 375,000 b.t.u. were required for one ton of steel. The efficiencies of various installations were computed with relation to this as a standard. In an investigation of *zinc losses in hot dip galvanizing* he prepared a metal balance sheet which,

by showing that all the metal could be accounted for, disproved the theory held by many galvanizers that zinc was lost by evaporation[172]. The same author presented a paper[173] on the *effect of copper on hot dipped zinc coatings* in which he stated that available evidence indicates that a small copper content will increase the corrosion resistance of the coatings. This is a little known subject on which much time could be spent in research.

Baldwin discussed the *control of the hot galvanizing process* in order to get the maximum spread of the limited zinc supply[174], while Wean[175] patented a method for *hot galvanizing sheet steel* which involved the use of a controlled iron content in a portion of the depth of the pot. Bridston described the *hot galvanizing installations* at the Puget Sound Navy Yard and the Seattle plant of the Pacific Car & Foundry Co.[176] His detailed and illustrated description of the furnace construction should be of much interest to hot galvanizers.

Electroforming-Plating Non-Conductors

The patent literature provided the greater part of the items of interest on both the metallizing of non-conductors and on electroforming. Technical literature offered only two articles worth reviewing, one by Wein[177] on the production of copper, gold, nickel and lead sulfide *mirrors on non-conductors* and the other by Libberton[178] who described the use of a double spray gun method for applying the silvering solution and the reducer. Although the latter paper was presented from the standpoint of the requirements of the electrotyper for coating wax and plastic molds, the methods is applicable to all metal finishing applications of this type.

Walker[179] patented the *treatment of plastics* with a solution of stannous chloride and hydrochloric acid before silvering, Bartoe[181] claimed a treatment for 12-48 hrs. with a *concentrated alkali hydroxide*, which was said to make an alphamethacrylate resin receptive to silvering and Loiseleur[182] put them all to shame by specifying 4 *treatments* before silvering.

Metallizing processes not involving chemical reduction of silver on the surface were also the subjects of patents. Ward patented a *coating for glass* consisting of finely divided flakes of a metal dispersed in an organic film substance and a solvent therefor[183], Lang[184] deposited a *conducting film* by *reduction of nickel carbonyl* to metallic nickel and Gillett[185] rubbed glass with rods of zirconium and titanium to produce an adherent film of those metals.

Norris[186] added three more patents to his collection on the production of *electroformed screen*, Wise & Vines[187] patented a process for *electroforming reflectors*, Spelker[188] claimed a method of *producing a marking tool* and patents were issued to Bull[189] and to Bishop & Bull[190] for *tire molds*.

Testing and Control

A novel *portable pH testing apparatus* consisting of two antimony electrodes, one in contact with the solution and the other with a standard pH buffer solution which was kept from mixing with the solution under test by a semi-permeable diaphragm, was patented by Brengman & Parker[191]. The development of a method for *determining the amount of oil* on a surface by fluorescence was discussed previously[62]. Monaweck[192] found that elimination of cyanide by boiling with hydrochloric acid during the *determination of ammonia in brass solutions* resulted in the generation of additional ammonia. Acidifying with sulfuric acid precipitated the cyanide or drove it off, so that after the precipitate was filtered out, the ammonia could be determined with accuracy.

Halls[193] discussed the *analysis of nickel plating solutions* for all the usual constituents and the interpretation of the results with the use of charts. Jernstedt[194] described *high speed methods of analysis* and control using a centrifuge and spectrophotometer, claiming reduction of the analysis time to from 1/10 to 1/2. The author stated that with the "high speed" methods one man was able to perform 70 analyses per week with an average of 4 constituents in each solution analysis. Using the methods outlined in the "Plating & Finishing Guidebook" for the most part, one man in our own laboratory has often turned out this number in half the time, so that we still remain unconvinced.

A simple series of spot tests for the *systematic identification of common metallic coatings* was offered by Neckamkin & Sanders[195] while the *thickness of deposit* was the subject of articles by Gallagher[196] who gave a short description of the use of the reactance bridge circuit in *electromagnetic gauges*, and by Ballard[197] who presented a modification of the Clarke jet test for determining the *thickness of fired gold coatings* on ceramic materials, using an acidified iodine, ammonium iodide solution with a wetting agent.

Heussner[198] made a comparison of *salt spray and ocean water spray accelerated corrosion tests*. The latter was found to be more severe than the former at 95° F. while at 72° F. they were nearly equal. The difference in the effect of temperature was believed to be due to oxygen solubility effects. Since the 20% salt spray gave results which were less affected by temperature variations, this solution was considered preferable. The author also determined that while chromium over nickel increased the salt spray resistance, under actual outdoor service conditions the chromium is only useful in preventing tarnish and corrosion of the nickel deposit. In an evaluation of salt spray tests of oiled black oxide coatings on steel, Graham[199] pointed out the importance of the *position of the article in the salt spray chamber* on the results of the tests, which factor is to us one of the serious drawbacks to salt spray testing, especially of recessed articles.

Miscellaneous

The advantages and disadvantages of various types of *direct current equipment*, including motor-generator sets, rotary converters and rectifiers were detailed by Fletmeyer[200]. Burton explained the methods of *connecting and operating rectifiers* to obtain satisfactory control during electroplating and anodizing treatments[201]. Coffin discussed the *types of tanks* which were most suitable for containing various metal treating solutions[202]. Hall[203] surveyed the *technical literature* published and the patents granted during 1941 and pertaining to the finishing industry and Cook[204] described the *health hazards* encountered in defense industries and the application of Industrial Hygiene methods.

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Throwing Power of Plating Solutions

By DR. C. B. F. YOUNG[1] & AL ZMINKOSKI[2]

THE term "throwing power" is used nearly every day by the plater and one would think that it would be a comparatively simple task to define the phrase. This is not true however, as a quick survey of the literature will prove. The greatest trouble seems to be that all are not trying to define the same property each time; secondly the phrase is used to cover a "multitude of sins". A brief resume of the literature will be given and then the authors will endeavor to give a simple method which has been used to advantage to determine this or similar factors.

Throwing power[3] has been defined as the per cent improvement of the metal distribution ratio above the primary current distribution ratio. Thus,

$$\% \text{ Throwing power} = \frac{\text{p.c.d.r.} - \text{m.d.r.}}{\text{p.c.d.r.}} \times 100$$

Where m.d.r. (metal distribution ratio) = $\frac{\text{Metal deposited on near portion of cathode}}{\text{Metal deposited on far portion of cathode}}$

The expression p.c.d.r. (primary current distribution ratio is derived from a relationship of the resistance of the solution and the distance between the anode and a specific part of the cathode. This factor is, of course, equal to the reciprocal of the distance ratio.

Thus, p.c.d.r. = $\frac{\text{distance from anode to far portion of cathode}}{\text{distance from anode to near portion of cathode}}$

If p.c.d.r. is shortened to d.r. we have:

$$\% \text{ Throwing power} = \frac{\text{d.r.} - \text{m.d.r.}}{\text{d.r.}} \times 100$$

If it is assumed that a perfect throwing power is obtained, that is, m.d.r.= 1, then, for a distance ratio of 2, 3, and 4, we would have throwing powers as shown:

$$\frac{2-1}{2} \times 100 = 50\%$$

$$\frac{3-1}{3} \times 100 = 66.6\%$$

$$\frac{4-1}{4} \times 100 = 75\%$$

Therefore, the perfect throwing power increases and approaches 100% as the distance ratio increases and approaches infinity. Pan[4] has published some experimental work in the field and has defined throwing efficiency as follows:

$$\% \text{ Throwing efficiency} = \frac{\text{Actual throwing power}}{\text{Ideal throwing power}}$$

or

$$\% \text{ Ideal Throwing Power} = \frac{\text{d.r.} - 1}{\text{d.r.}} \times 100$$

$$\% \text{ Throwing efficiency} = \frac{\dfrac{\text{d.r.} - \text{m.d.r.}}{\dfrac{\text{d.r.}}{\text{d.r.} - 1}}}{\dfrac{\text{d.r.}}{\text{d.r.}}} \times 100 = \frac{\text{d.r.} - \text{m.d.r.}}{\text{d.r.} - 1} \times 100$$

Pan (Loc. cite) defined throwing efficiency from the above as follows: "Throwing efficiency may be defined as the amount of actual improvement of metal distribution ratio over primary current distribution ratio, in comparison with ideal improvement based on perfectly uniform deposits over all parts of cathode.". It can readily be seen that "throwing efficiency" gives more uniform results than "throwing power" when the distance ratio is varied, but the results still depend upon this factor. It would seem that a better method could be used in commercial determinations.

On this and related subjects Dr. Kasper[5], National Bureau of Standards, Washington, D. C., has made some very interesting geometrical and mathematical analyses. The reader is referred to this work for a comprehensive examination of problems involved in some geometrical systems. It is the opinion of the authors that this work has not been utilized to its full advantage. In a discussion, Dr. Kasper[6] has the following to say: "Throwing power devices, and by this I mean an arrangement that exhibits a wide continuous variation in current density, are satisfactory for the

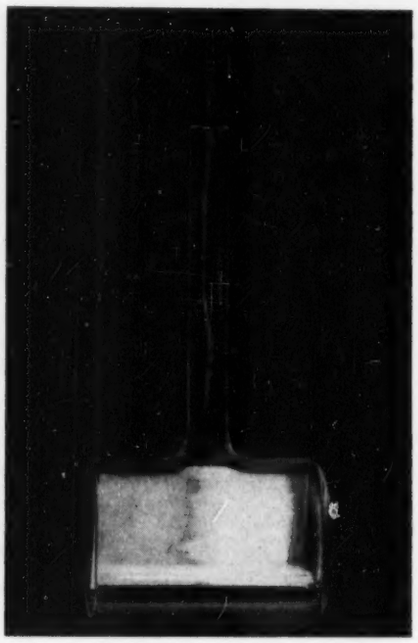

Fig. 1. Small cavity scale. Contact with the ¾" x 1¼" cathode sheet is made by a wire with a forked end which is inserted through the vertical glass tube.

disclosure of plating ranges in exploratory investigations or in seeking control of a solution with known characteristics. The assertion as to whether one solution will plate more uniformly than another must rest on an examination of the polarization curves, conductivities, and current efficiencies. It is not to be expected that a positive answer will always be possible, and any question of the commercial importance of differences that are indicated must be settled with the particular object to be plated. However, to expect that a particular scramble of the data will yield intelligent information, where the plating of any particular object involves its own particular scramble, is quixotic; if agreements are found, it simply indicates that a simpler problem (i.e., only the current efficiency) or extremes are being dealt with. The use of 'throwing-power boxes' is not to be encouraged, particularly since they interfere with the recording of the fundamental data. In view of the fact that they have been the source of so much confusion, I am quite in favor of 'throwing them out'. They serve no useful purpose."

Methods of Analysis

From the above one would conclude that the speaker has very little faith in data obtained by using throwing power boxes. One might well ask just what can be used to determine the complex property of throwing power. The best cathode method has been used in chromium plating baths by many experimenters. This consists of bending brass stock of a certain definite width to a sharp angle, for instance, up to 90°, and placing this bent piece in the plating bath in such a way as to have the bottom piece nearer the anode than the upright leg. The distance the chromium deposit is plated on the near point is one indication of the throwing power. Other factors can be obtained by a study of the deposit but these will not be mentioned here. This is discussed in detail by Sizelove[7] and Pinner and Baker[8].

Another method comes up for analysis which came to the attention of the senior author several years ago. It is known as the "cavity scale method" and again the amount of area covered is an indication of the throwing or covering power of the solution. The

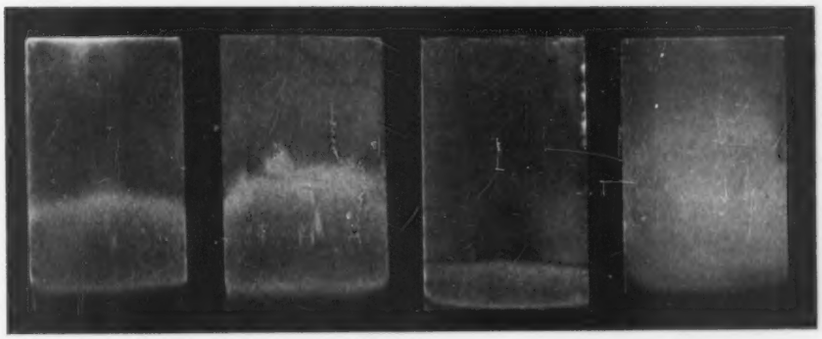

Fig. 2. Throwing power cathodes. The bottom portions of the sheets are chromium plated. Reading from left to right: Nos. 1 and 2 are from a regular chromium solution and are 50% plated. No. 3 is from a solution with a 50:1 sulfate ratio and is only 15% plated. No. 4 is from a solution with addition agent and is 100% plated.

method consists of inserting a strip of some suitable buffed metal strip such as brass into a cavity of definite diameter and length, one end of which is open while the opposite end is closed. Contact is made through a side are so that the strip becomes the cathode in the bath to be tested. A deposit is produced, under controlled conditions of temperatures, time, current density and voltage, which is examined for the area covered, bare spots and their shapes and types of deposits. From these a wealth of information can be obtained about the solution in a few minutes. Pan[9] first published information on this method and the metal studied here was chromium. A cavity scale for chromium solutions is shown in Figure I.

Since this time S. C. Taormina[10] has done a tremendous amount of work in this field. He has standardized on a cell which is $\frac{7}{8}$" dia. x $1\frac{3}{8}$" with one closed side. Note how contact is made, in Figure I, with the polished cathode sheet which is $\frac{3}{4}$" x $1\frac{1}{4}$". This is introduced into a 600 cc. beaker which contains 378 cc. of the chromic acid (0.1 gallon) at the desired temperature, generally 40° C. A current density of 1 amp./sq. in. or 1.95 amp. is applied for five minutes. The anode area should be two square inches but above this it is not critical. With the current density above, it should be possible to deposit chromium over 50-60% of the strip using four to six volts. If, in order to deposit chromium over this cathode area, a higher voltage is required, the trivalent chromium is too high.

In Figure II it will be noted that the first and second pieces, numbered

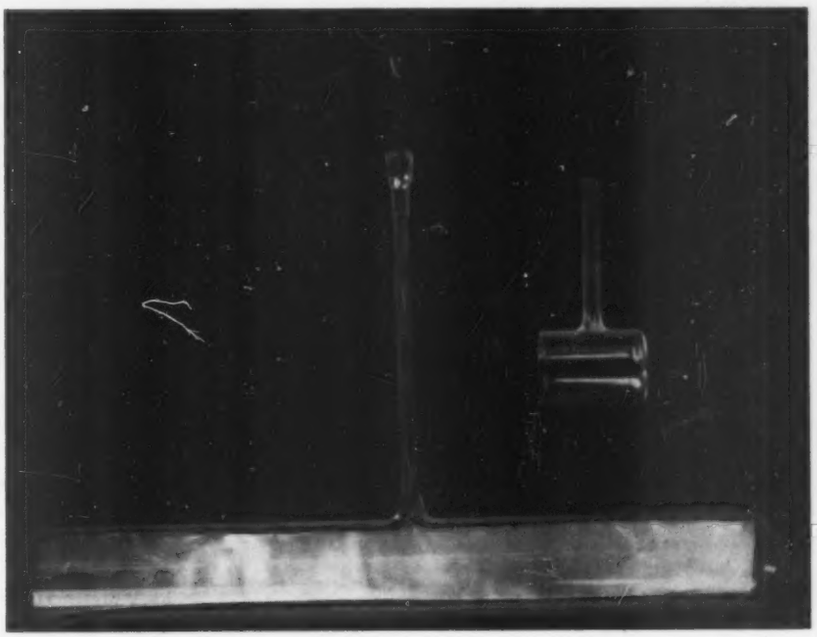

Fig. 3. Large cavity scale for solutions with better throwing power. The small cell of Fig. 1 is included in the photograph for comparison.

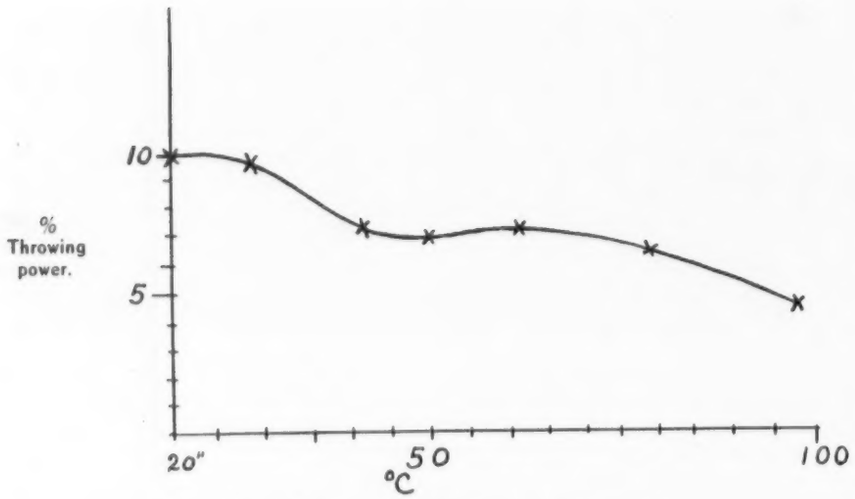

Fig. 4. Graph of per cent throwing power vs. temperature.

TABLE I

Temp.° C.	20°	30°	40°	50°	65°	80°	98°
c.d. amp./sq. ft.	7	7	7	7	7	7	7
Volts	1	1	1	1	1	1	1
Time in min.	2	2	2	2	2	2	2
Depth of throw in inches	1.00	1.00	0.75	0.70	0.75	0.625	0.437
% T. P.	10.0%	10.0%	7.5%	7.0%	7.5%	6.25%	4.37%

from the left, are about 50% covered with chromium. Each of these was obtained by inserting a highly buffed piece of copper into the chromium cavity scale shown in Figure I and plating for five minutes, using 1.9 amps. at 4.50 to 4.75 volts. The solution was at a temperature of 40° C. In fact these conditions were used on all four pieces shown. Each deposit was obtained in a standard chromic acid bath, both baths having a ratio of CrO_3-SO_4 of 100-1.

The third strip from the left was also plated as above. The only difference between the first two and the third is the ratio of CrO_3-SO_4 which in this case is 50-1. It will be noted that the deposit of the chromium is only 15% of the whole. Therefore, by decreasing this ratio it is possible to decrease the throwing power 35% as measured by the cavity scale. The ratio was decreased by adding sulfuric acid to one of the standard baths used above.

The fourth strip in the illustration was obtained by using a standard chromic acid (ratio of 100-1) at the conditions given above. To this bath, however, was added a second catalyst developed by S. C. Taormina. In this case the sulfate radical is considered as a catalyst also. It will be noted that here the throwing power as determined by the cavity scale is 100% or the chromium deposited covers the entire copper cathode. It should also be mentioned that the "Taormina catalyst" increases the cathode efficiency of an ordinary chromium plating bath. Such a material should have industrial application.

Cavity Scale Determines Other Factors

There are other factors which can also be obtained using the cavity scale. By a simple weighing before and after, the cathode current efficiency can be determined. Also it will be noted that on the open end of the plated cathode, there is a small area which has a frosted plate. On the normal deposit, that is, one that has 50% of the cathode area covered with chromium, the frosted area is about ⅛" or 0.125" deep. If the frosted plate is deeper than this figure, it generally indicates high trivalent chromium and/or high sulfate radical. This frosted area ordinarily is about 20-25% that of the total area plated. Sometimes, if the contact is broken during plating, the whole area of deposit will be frosted. If the sulfate content is low (CrO_3-SO_4 = 150 or 200-1), there will be a slight increase in throwing power up to 150-1 but the deposit has a tendency to show rainbow colors and indicates low cathode efficiency which of course is due to low sulfate content. Above this figure and up to 200-1 etc., there is very little plate—only a discoloration of the cathode. Regardless of the catalyst used, namely sulfate, fluosilicate etc., standards can be made of plated strips using varying amounts of the catalyst so that proper control can be indicated by the cavity scale. Therefore a chromium plating bath can be controlled by this method and a simple Baumé reading without resorting to a chemical analysis either for CrO_3, catalyst, such as SO_4, trivalent chromium and impurities. There are a number of chromium baths which have been controlled by this simple method for a number of years. The time required to make this test is only about ten minutes. Therefore, the whole determination, cavity scale, Baumé reading, setting up and taking down apparatus, will require no more than twenty minutes and the whole determination only requires a small six volt current source, a depositing cell consisting of a 600 cc. beaker, etc., a cavity scale, a resistance, a Baumé hydrometer, a cylinder for holding the hydrometer and an ammeter. This material can be obtained around any laboratory or can be purchased for a small amount of money. With the exception of the cavity scale which should be blown to scale, this will cost less than a dollar.

After a few determinations one becomes adept to the method and can tell in a very few minutes the general trouble of a chromium plating bath. This same trouble will many times take twenty-four hours to identify if the bath is analyzed in the usual way. This is a quicker and less expensive way of determining sulfate content than is the method of precipitating the ion with barium salts and then using the well-known centrifugal method.

With the above in mind the senior author desired to see whether this method could be applied to a throwing power study of other metals. One might ask just what is throwing power. A simple definition would be "The ability of a solution to deposit in recesses or far away areas of the cathode". If this definition can be agreed upon as covering the field, one might say that any method which gives a measurement of contrast between the

far and near parts of the cathode and *these areas being in metallic contact* will indicate the general trend of the throwing power of a given solution. It will be noted that the above says "indicates the general trend". It is the opinion of the writers that the phrase "throwing power" covers many complex properties and, as such, a method of testing and determining the absolute quantity is a very difficult problem. However, in studying plating solutions the research engineer and practical plater many times would like to determine the actual trend of throwing power under a given set of conditions. We are now ready to consider the cavity scale with respect to other baths besides chromium.

Chromium has a very poor throwing power. In fact, using the definition of throwing power as defined by Haring and Blum this property has been found by Farber and Blum[11] to vary from —13% to —100%. Under the same conditions nickel has a throwing power of 0% and cyanide copper from 20-40%. In order to make these tests an appreciable amount of apparatus must be at hand and several electrodes must be weighed and reweighed. Would it be possible to arrive at values optically which would give indications of the trend of throwing power? The authors believed that a modified cavity scale if employed correctly could be used to accomplish this. A cell was designed which was one inch in diameter by ten inches long, with one end open and the other end closed. A side arm was placed in the center of the tube which acted as a vent for cathode gases and contact for the cathode. A picture of this apparatus is shown in Figure III. The method of using the unit was to immerse it in the solution to be tested. The distance of the anode from the near end of the cathode was two inches. The current density and temperature corresponded to those used in ordinary plating. The efficiency was measured directly. For instance, if the cathode was a polished nickel strip, 1"x10", and the solution deposited metal on the first two inches, the throwing power was:

$$\frac{2}{10} \times 100 = 20\%$$

Several baths have been used by the authors for experimental purposes, namely, cadmium, nickel, cyanide copper and acid copper. In the tables below, data are presented for acid copper baths. The first variable studied was temperature vs. throwing power. The bath was composed of:

$CuSO_4 \cdot 5H_2O$	200 g./l.
H_2SO_4 (sp. gr. 1.84)	50 g./l.

The cathode area was 20 sq. in. and was made of polished brass. The bath was heated from 20° C. to 98° C. From Table I and Figure IV it can be seen that as the temperature increases the "throwing power" decreases. This is in agreement with good plant practice. Just why there is a hump in the curve at 65° is not known. Perhaps this should be investigated more closely The authors have tried to be accurate in the determinations and all results were checked. From the above results one would say that the modified cavity scale has possibilities for determining the ability of a bath to throw into recesses.

With this in mind it was decided to run other tests and see just what the results would be. Among those selected was the effect of a wetting agent upon acid copper baths. The material selected was "Duponal 80" a product of the duPont Co., Wilmington, Delaware, which is a a sulfonated alcohol. A 10% solution of this material was made up and used as a standard stock solution. This was added to a liter of the acid copper solution above. The results are given in Table II and Figure V.

From the above one can see that a small amount of the wetting agent increases the ability of the solution to throw into recesses but after that, it is of no effect. This is not conclusive, however, and more work should be done before general statements are made.

Conclusion

The term "throwing power" covers a mulitude of properties and undoubtedly conflicting results in the literature are due to a misunderstanding of these factors, and to methods used for determining them. The ordinary throwing box results vary unless the same size box and distance ratio are used. There is need for a

TABLE II

cc. 10% "Duponal 80"	10	20	30	40	50
Temp. °C.	20	20	20	20	20
Current Density amp./sq. ft.	7	7	7	7	7
Volts	1	1	1	1	1
Time in minutes	2	2	2	2	2
Depth of throw in inches	1.25	2.0	1.5	1.5	1.0

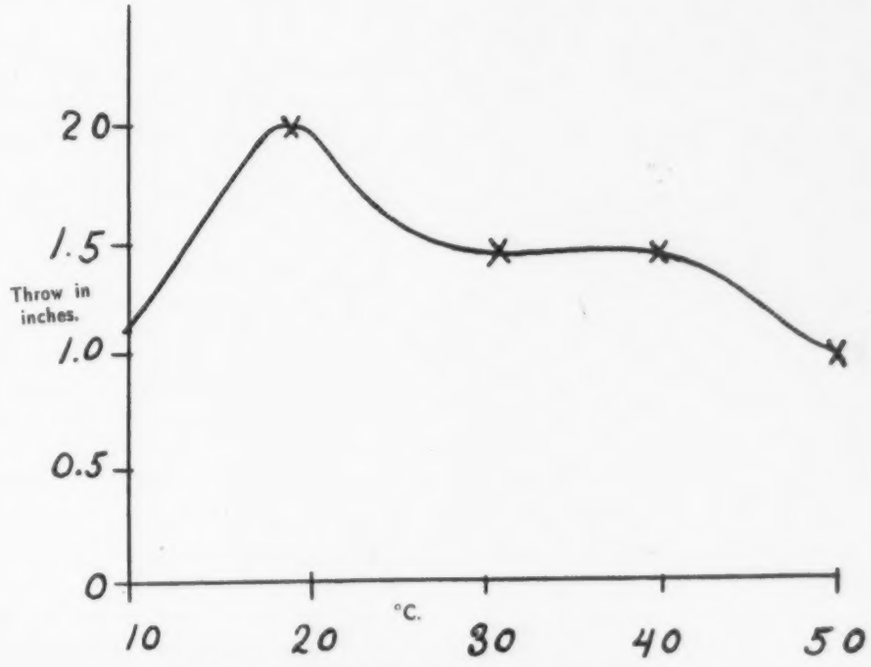

Fig. 5. Graph of depth of throw vs. cc. Duponal.

more simple and direct determination of the throwing power factor. The cavity cell can be used to determine throwing power and other factors.

The authors have endeavored to use a modified cavity scale for determining the over-all effect of throwing power. From the somewhat limited laboratory work so far completed, it appears that the method has possibilities. It should be pointed out, however, that the results will depend upon the size and shape of the cavity tube the distance from the anode to the cathode and the cathode material. The tube can be lengthened to suit suit any type solution. Thus, if it is found that a solution will throw more than 10", a tube could be used which had a length of 20", etc.; or the diameter of the tube could be decreased to 0.75" or 0.50", etc.

The authors realize that this is not a "cure all' method; however, it is simple to operate and make determinations. There are no weighings whatsoever to be made. It should be kept in mind that different shaped tubes can be used if desired so as to approach complicated systems which are encountered in industrial practice. The authors would be pleased to hear from any readers and receive their comments.

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Interesting Facts About Metals

By JOSEPH DANFORTH LITTLE

The nation's oldest steel company is the Taylor-Wharton Iron & Steel Company at High Bridge, N. J. It recently celebrated the 200th anniversary of the founding.

+

The first cast iron pipe used in this country was imported from England in 1817 and was used in Philadelphia, Pa.

+

It is estimated that New York City alone has over 8,000 miles of cast iron pipe ranging from 3 in. to 6 feet in diameter.

+

The greatest gold producing region is in the Witwaterstrand district of South Africa. Johannesburg is the largest mining center and the output of gold some years has exceeded $150,000,000.

+

One of the deepest gold mines in the world is the Morro Velho mine in Brazil, said to be over 6,100 feet deep.

+

The world's production of gold from discovery of America to date is estimated to be over $17,000,000,000 and weighing about 25,000 tons. It has been estimated that this would make a solid circular tower of gold 20 feet in diameter and 140 feet high.

+

The first bath tub was built about 1830 by Adam Thompson who returned from England to Virginia. It was made of mahogany, sheet lead lined and weighed a ton. Well water was pumped to an attic tank and heated by a chimney coil. It did not meet with general approval. Later the state of Virginia levied a tax upon bath tubs as did Wilmington, Providence, and Hartford, while Boston officially forbade bathing except on medical advice.

According to estimates, under the streets of Butte, Montana, there are 2000 miles of mine tunnels.

+

In 1921 the British Government began to reduce the silver content of its silver coins from 925 parts of silver to 500 parts.

+

Under Caesar silver was employed for articles of convenience upon a scale never afterwards emulated. He speaks of the ladies of his time disdaining bathing-tubs unless they were made of silver.

+

Pliny, who was born in 25 A.D., mentions a slave of Claudius, Drusillanus, by name, the treasurer of Hither Spain who had a dish made of silver, made in a forge built for the purpose, weighing 500 pounds, with eight plates to match, weighing together 250 pounds. Pliny sarcastically asks how many of his fellow slaves it took to carry in this dinner service, and who were the guests it was set before.

+

It has been estimated that about 2,000,000,000 pounds of copper are continuously in use in American automobiles and railroad systems.

+

It has also been estimated that our telephone and telegraph systems alone have 70,000,000 pounds of copper in use.

+

Copper plays an important role in transmitting our messages. George Washington complained that it took a month to get a letter to him at Mount Vernon from New York City. Copper is of such assistance that, with the aid of the telephone, it is possible to get a communication between these two points in five minutes.

Preparation of Surfaces for Hard Chromium Plating*

By ARTHUR W. LOGOZZO

Hartford Chrome Corporation
Hartford, Conn.

THE present war effort has pushed many types of plating into the background and also elevated other types to previously undreamed-of pinnacles. Hard chromium perhaps leads the field in this more fortunate group. Its unchallenged combination of physical properties—hardness, resistance to high temperatures because of its high melting point, resistance to abrasion due to the combined efforts of its hardness factor and the lowest coefficient of friction of surface of any metal—makes it invaluable to the manufacturer.

As a salvage medium it is playing an important, never-to-be-forgotten part in keeping war production moving. As a protection medium on new tools, dies, gauges, etc., it is unexcelled. Yet there is room for much improvement in this field which can be attained only by an intensive study, the importance of which is being greatly magnified by the fact that men's lives now depend on the results.

Many papers have been written on what lies under the plate and the proper pre-plating preparation of the same. The importance of this phase as far as hard chromium goes cannot be overstressed.

Proper Heat-Treating

The proper heat treating of base metal is essential prior to hard chromium to relieve stress and strain which otherwise would be greatly accentuated by the chromium plate. Mr. Jack Wilson of the General Electric X-Ray Corporation has analyzed chromium plate by X-Ray and has come to some interesting conclusions as shown in Figures 1 and 2—both taken by means of the X-Ray diffraction pattern by direct transmission through thin metals.

Fig. 1 (Pattern A)—Shows a piece of aluminum chromium plated. This pattern shows a high degree of preferred orientation of crystalline structure at the time the piece was plated. A shifting of crystalline structure took place during aging and caused a cracked condition in the plate.

Fig. 1 (Pattern B)—Shows a relieving of the condition prevalent in Pattern A. This piece showed no signs of cracking in service.

Fig. 1 (Pattern C)—Shows a steel specimen properly heat-treated before plating.

Fig. 1 (Pattern D)—Shows the same piece of steel plated, indicating *fine nature* of chromium deposit. This was extremely satisfactory as a wear resistant in service.

Fig. 2—Shows the pearlitic structures under the plate. Patterns A-C-E show degenerate pearlitic structures under the plate. Patterns B-D-F indicate true pearlitic structures showing better quality of plate.

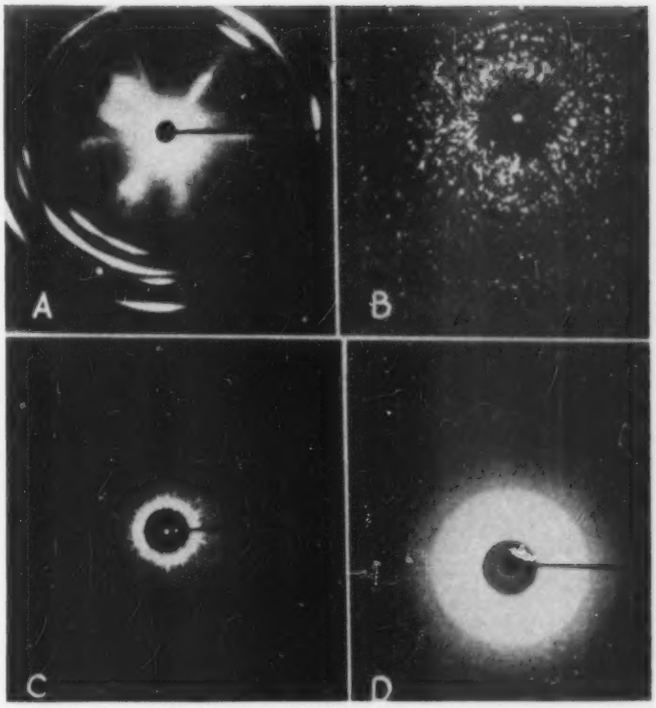


Figure 1.

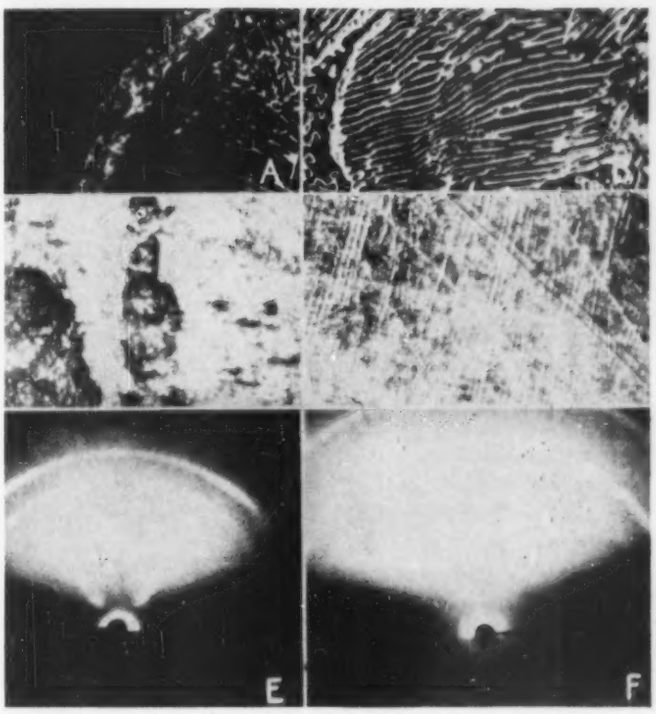


Figure 2.

* *Presented at the 30th Annual Convention of the American Electroplaters' Society held June 8-10 at Grand Rapids, Mich.*

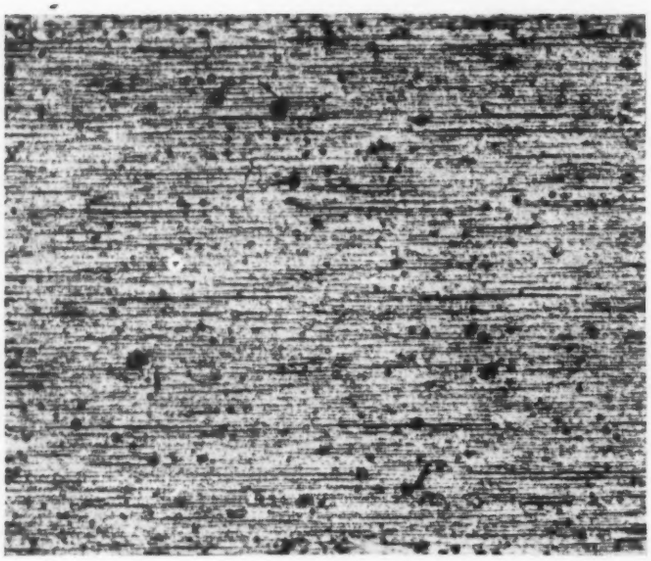


Figure 3.

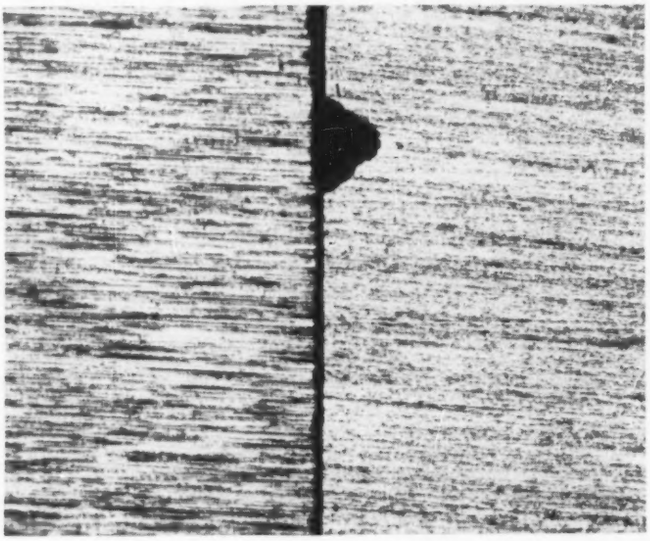


Figure 4.

Cleaning and Pickling

Work is degreased in an organic solvent when necessary; then anodically treated in an alkaline bath and pickled for several minutes in muriatic acid containing a wetting agent. This prepares the surface for the physical treatments to follow.

Various Types of Physical Treatments

Most work when sent to the hard chromium shop has a ground finish. Some parts such as gauges are lapped. The following slides show various surface conditions of hardened steel and the finished product with 0.005″ of chromium. All photomicrographs are taken at twenty (20) magnification.

Fig. 3—All etching was done in 28 oz./gal. CrO_3—Temp. 120° F. A ground surface with no preliminary lapping or buffing before plating showing 0.002″ chromium deposit. Etched for two minutes. Note rough, nodular, porous nature of plate.

Fig. 4—The unnotched half of slide shows a ground finish. The notched half presents a lapped finish. Note difference in surface structure.

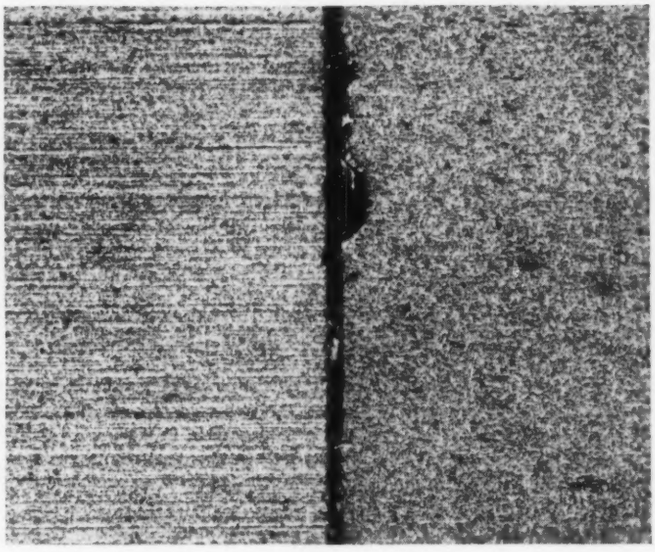


Figure 5.

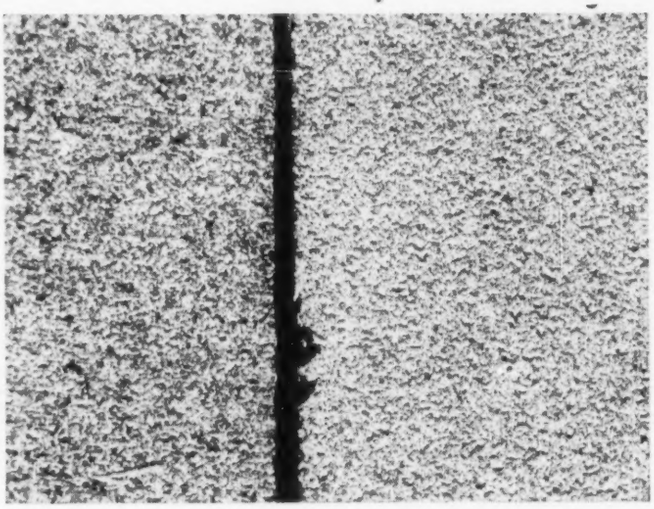


Figure 6.

Fig. 5—This slide is the same as *Fig.* 4 except for the fact it has been etched for 10 minutes—anodically—in CrO_3. Note reduction in nodular condition.

Fig. 6—A surface that has been grit-blasted. The unnotched half is grit blasted only with a number 80 carborundum grit. The notched half has been given the same grit treatment plus an etch in CrO_3 for 10 minutes. Note the finer appearance of the etched half of slide.

Fig. 7—A surface that has been ground-lapped and buffed. Scratches merely represent buffing lines.

Fig. 8—The unnotched half has been ground-lapped-buffed and etched for 10 minutes—anodically—in CrO_3. The notched section is a soft steel-ground finish and 10 minutes etch.

Fig. 9—The unnotched half has been ground-etched for 10 minutes and plated with 0.005″ chromium. Note difference between this properly etched specimen with 0.005″ of chromium and a similar specimen, *Fig.* 3, with an improper etching medium and only 0.002″ of chromium deposited on it. The notched half represents a grit-blasted surface—10 minutes etch and 0.005″ of chromium.

Fig. 10—The notched section has been ground-lapped-etched for 10 minutes and plated with a 0.005″ thickness of chromium. The unnotched half has been ground-lapped-buffed-etched for 10 minutes and plated with 0.005″ thickness of chromium. Note the fine, uniform appearance of the chromium deposit.

Fig. 11—The notched area is a specimen of unhardened tool steel that has been ground. The unnotched half is a study of the same specimen etched for 10 minutes and plated with 0.005″ thickness of chromium. The soft steels do not seem to reproduce as good a result as do the hardened steels.

Fig. 12—Representing the surface condition of a steel mold used in the manufacture of plastics after it had been in service for a while. The heavy lines represent wear and scoring while the heavy spots indicate large pits caused by the reactions between the compounds and the steel.

Fig. 13—A mold surface as it appears after polishing and before plating.

Fig. 14—The same surface as shown in *Fig.* 13, after chromium plating 0.001″. This piece has also been buffed after plating. The lines visible in *Fig.* 11 are undoubtedly removed in the etching medium.

Figure 7.

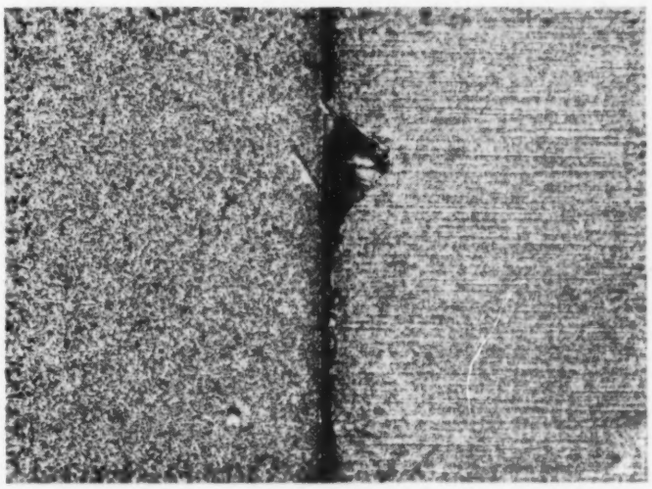


Figure 8.

Hydrogen Embrittlement in Hard Chromium Plating

We all know hydrogen embrittlement has caused much grief in hard chromium plating. We also know that any hydrogen occluded during the plating operation can be removed by the proper heat treatment after plating. Recent publications have shown higher temperatures than previously believed necessary will handle this situation satisfactorily. As shown by the X-Ray photos, relieving of stresses and strains before plating is important.

If our cleaning, pickling and etching operations were set up to give a minimum of hydrogen at the work surface, the only place we would have to contend with this evil would be in the plating tank. To accomplish this we merely stick to anodic cleaning in our alkaline bath, use an addition agent in the pickle for free gassing and better wetting of the surface and use the anodic treatment in the etching medium. It is also better to eliminate as much as possible the additional cleaning in the plating tank. This cleaning operation is accomplished by leaving the work at a voltage below the plating range for several minutes. Inasmuch as this operation involves considerable hydrogen it might be advisable to forego it.

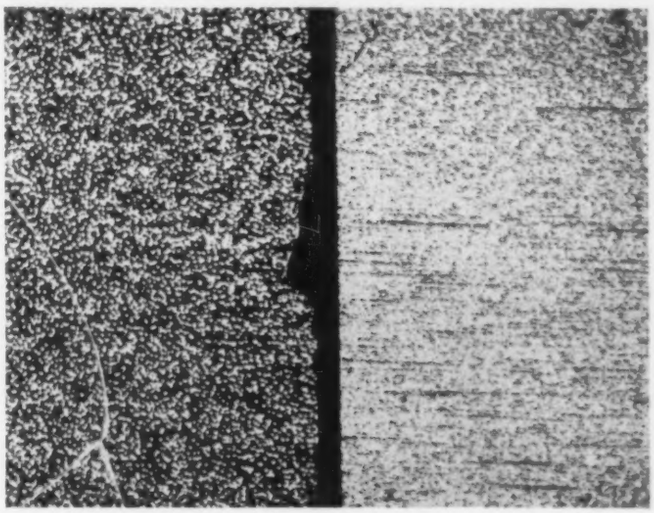


Figure 9.

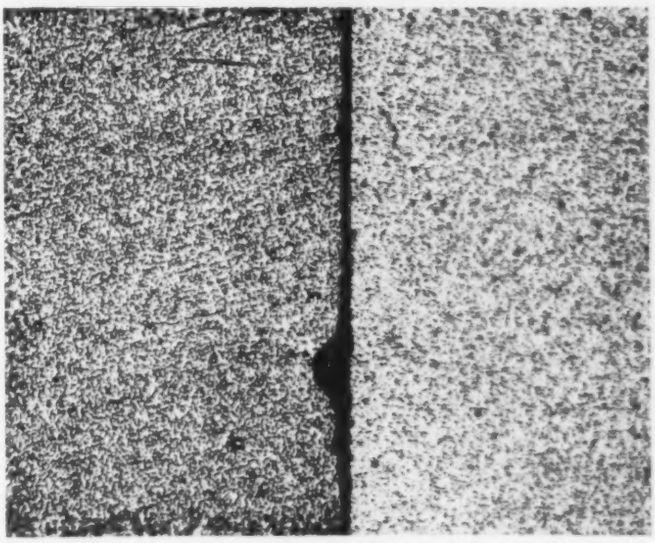


Figure 10.

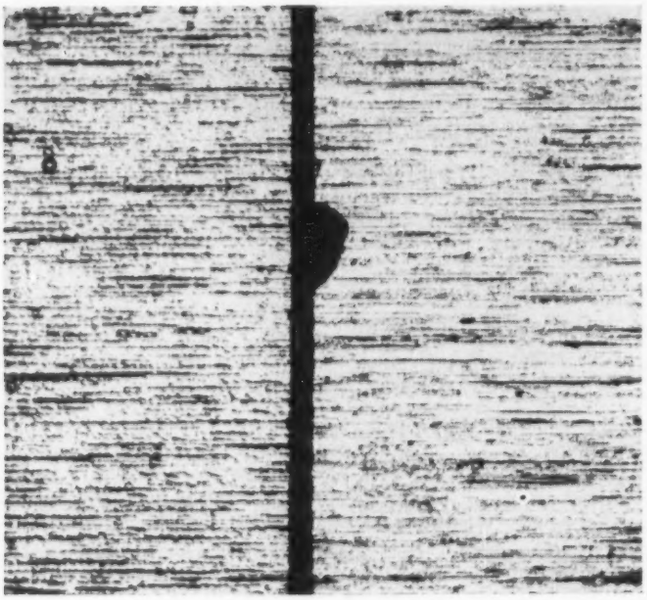


Figure 11.

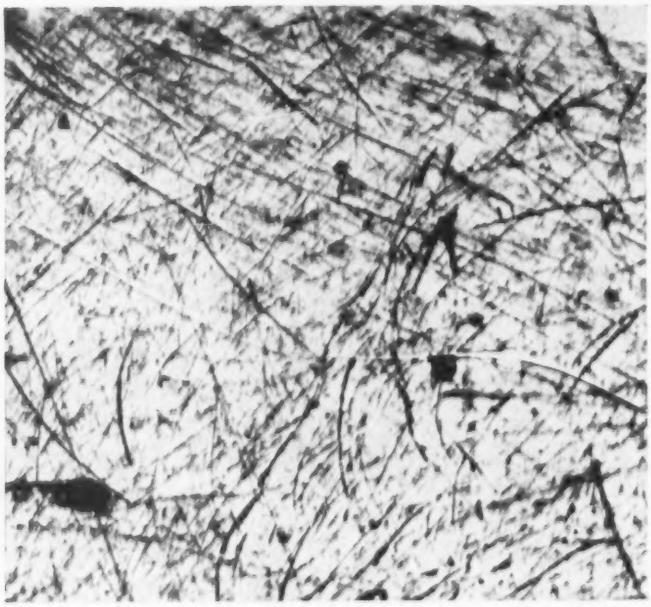


Figure 12.

An air bubbler or some other means of agitation in the plating bath is also helpful, by gently turning over the solution and keeping the gases moving. All mechanical set-ups should be arranged to permit a free circulation of solution and gases.

The heat treating after plating should be closely controlled. An underdose of baking will not remove all occluded hydrogen. Too high a temperature is detrimental since the grain size of the chromium deposit increases and the hardness decreases. It is suggested that the plater work in close conjunction with the metallurgical department in regard to just how much heat various compositions of steel will stand.

Conclusions

1. A case history of work brought into the hard plating shop would help considerably in properly setting up the parts.

Figure 13.

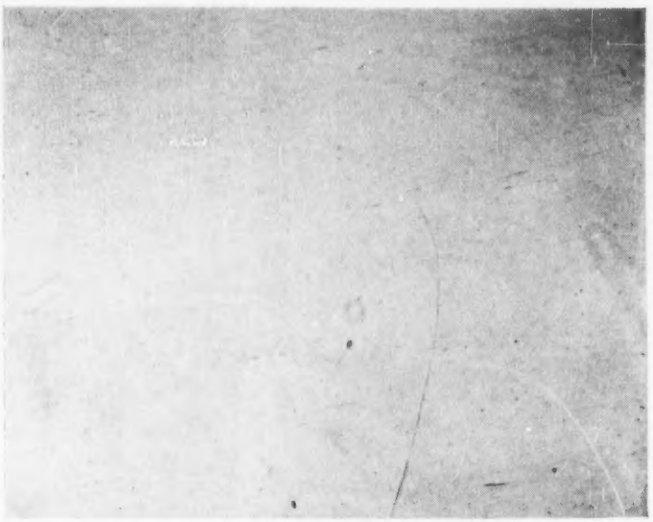


Figure 14.

2. Proper heat-treatment prior to plating. The X-Rays proved beyond a shadow of a doubt the feasibility of this requirement.

3. Physical treatments should be determined by the type of work to be plated and also its function after plating.

4. All work should be cleaned anodically only. This eliminates working with hydrogen at the work surface.

5. The hydrogen overvoltage method of cleaning in the plating bath should be eliminated. This involves considerable gassing of hydrogen at the cathode.

6. Heat-treating (within the range 300-500° F. depending upon the metal) after plating is essential to remove occluded hydrogen.

7. The grain size of hard chromium is controlled by the nature of the surface of the base metal. This is in keeping with the high reproducability of chromium plating. Consequently, great care should be exercised in the preparation of surfaces for hard chromium.

THIS IS WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent

1942 in a Nutshell During the year 1942 the various war agencies entered into about 70,000 prime contracts and nearly 700,000 subcontracts which totaled $52,500,000,000. The war production labor force rose from 7,900,000 in 1941 to 17,500,000 in 1942. In the first ten months of 1942 over $13,000,000,000 was collected in taxes, and over $13,000,000,000 was raised through the sale of bonds and other government obligations. During the first ten months of 1942 the average monthly man-days of idleness due to strikes were 396,888 as compared with 1,753,693 in 1941. The monthly war expenditures rose from $2,172,000,000 in January, 1942 to $6,112,000,000 in November 1942. The entire civilian personnel in the executive branch of the government throughout the United States rose from 1,670,922 on December 31, 1941 to 2,549,474 on September 30, 1942. Women employed as factory wage earners rose from 2,700,000 in October 1941 to 3,200,000 in October 1942. The United States copper supply rose from 2,400,000 tons in 1941 to 3,000,000 tons in 1942. One new zinc smelter and four zinc electrolytic refineries with an annual capacity of 216,000 tons were placed in operation in the United States during 1942. The Longhorn Tin Smelter in Texas, which began operations in April 1942, is being expanded to an annual capacity of nearly 100,000 tons. The electrolytic tin plate manufacturing facilities in the United States during 1942, which will save about 20,000 tons of tin a year, will soon be in operation. The United States supply of aluminum rose from 917,000,000 pounds in 1941 to 2,300,000,000 pounds in 1942. Magnesium production rose from 42,000,000 pounds in 1941 to 260,000,000 pounds in 1942. At the end of 1942 lead was supplied at the rate of 1,308,000 tons per year in 1942 as compared with the rate of 1,339,000 tons at the end of 1941.

Non-Ferrous Financing Out of that total a substantial amount comes under the head of non-ferrous metals and finishing materials. The sum of $5,925,120 was allocated to construct and expand alcohol plants; $26,984,280 to chlorine, ammonia, caustic soda and sodium nitrate plants; $5,665,162 to glycerine plants; $6,584,730 to phenol plants; $672,212,566 to 76 different aluminum and aluminum product plants; $2,902,756 to beryllium plants; $16,483,146 to chromium plants; $62,567,640 to copper plants; $1,493,000 to magnesite plants; $394,669,007 to 47 different magnesium plants; $6,565,000 to manganese plants; $20,670,000 to nickel plants; $4,170,000 to tantalum plants; $6,300,000 for a tin smelter; $423,465 to tungsten plants; $5,260,000 to vanadium plants, and $9,797,927 to zinc and lead plants.

Metals Reserve Company's Commitments Since its creation on June 28, 1940, the Metals Reserve Company, up to and including October 31, 1942, has made commitments totaling $1,812,087,030 for domestic activities and $1,412,261,293 for foreign activities. Out of the total $3,224,348,323 in commitments $5,308,000 was for cryolite; $5,765,000 for industrial diamonds; $5,480,000 for graphite; $107,497,252 for lead and lead ore; $149,453,000 for manganese; $12,872,000 for mercury; $9,673,000 for mica; $8,317,000 for nickel and nickel-cobalt speiss; $1,707,000 for platinum; $4,500,000 for foreign silver; $326,519,958 for aluminum alumina and bauxite; $272,212,121 for tin and tin ore; $166,112,350 for tungsten; $57,748,476 for zinc, zinc concentrates and zinc ore; $328,428,926 for copper and copper ore; $65,166,699 for chromium, chromium concentrates and chromium ore, and $12,698,000 for antimony.

Jones Reports to Roosevelt In submitting a report on November 30, 1942 to President Franklin D. Roosevelt on the activities of the Reconstruction Finance Corporation and its subsidiaries in connection with the War as of October 31, 1942, Secretary of Commerce Jesse H. Jones revealed that the Defense Plant Corporation has financed, or contracted to finance, the construction and expansion of industrial plant facilities amounting to a grand total of $7,535,599,735.

$829,332,800 Recovered During the seven month period, April 28, 1942 to December 1, 1942 inclusive, the renegotiation of War Department contracts has resulted in price reductions totaling $705,112,400 and cash refunds totaling $124,220,400.

Acetic Acid Adjustable Pricing Adjustable pricing for the sale of acetic acid effective December 2, 1942, was established by OPA in the issuance on November 27, 1942 of Amendment No. 2 to Revised Price Schedule No. 31. Due to a shifting of the cost situation with resulting changes which tended to make long term contracts risky transactions under the terms of this amendment the seller and the buyer are permitted to agree to fix prices on delivery which are no higher than the maximum prices in effect at that time.

Aluminum Products Emergency Shipments Since December 8, 1942 it has been necessary to secure a written statement of approval from the military procurement officer having jurisdiction over a war contract which requires emergency shipments of aluminum products prior to the month of normal allocation. Supplemental Form PD-26A, used for emergency shipments, under Order M-1-i, will not be approved unless the military procurement officer's statements is attached.

Bureau of Mines Report In his annual report of the Bureau of Mines for the fiscal year 1942, recently submitted to Secretary of the Interior Harold L. Ickes, Director R. R. Sayers states that large quantities of aluminum, chromium, magnesium, and manganese can be obtained from domestic deposits. During the year the Bureau tested and developed processes for benificiating ores containing antimony, copper, mercury, nickel and zinc.

Chemical Plant Committee Meeting At the first meeting of the newly appointed WPB Chemical Plant Facilities Industry Advisory Committee held in Washington on November 17, 1942, information was sought from the committee on the present chemical plant facilities which could be rapidly converted to the manufacture of such chemicals as ethyl cellulose, mannitol, ethyl alcohol, dibutyl amine, diethyl amine, ethyl aniline, furfural, sorbitol, monochlor benzene, phenol, thiokol, triacetin, tricresyl phosphate, triethyl phosphate, acetanilid, aluminum chloride, calcium carbide, calcium hypochlorite, dichlorethyl ether, silica gel, acrylonitrile, polyvinyl formaldehyde resins, and carbon black. At this meeting it was suggested, among other things, that silver replace nickel in making chemical autoclaves for ethyl cellulose.

Chemical Process Machinery Prices Chemical process machinery, such as "electroplating and hot-dip metal coating equipment, including preparatory and finishing equipment used in connection with metal coating processes", were included in Machinery and Transportation Equipment Maximum Price Regulation No. 136 as amended in Amendment No. 54 dated November 20, 1942. The maximum permissible prices for such equipment were fixed at the highest prices charged on October 1, 1941.

Chlorine Restrictions Eased General Preference Order M-19, as amended December 1, 1942, removed from control of the original order all products containing available chlorine, such as liquid sodium hypochlorite, calcium hypochlorite, sodium chlorite and other similar products. It also exempted from the order the delivery of 2,000 pounds of chlorine per month for water purification and sewerage treatment purposes. Under the amended order, buyers must place their purchase orders with distributors by the fifth of each month, and with producers by the tenth of each month. Forms PD-190 and PD-191 (revised) must be used in applying for authorization.

CMP Instruction Booklet Issued Those who participate in the forthcoming regional meetings to be conducted by the Controlled Materials Plan Division of the War Production Board, will be given the first copies of the booklet entitled: "General Instructions on Bills of Materials." After these meetings, copies of the instruction booklet may be had from the WPB's field offices.

Copper Price Order Clarified In the last paragraph on Page 3, (OPA-T-254 release issued on November 4, 1942), of Order No. 8 Under Maximum Price Regulation No. 204 dated November 3, 1942 it states: " . . . the War Production Board points out that sale of all items is not compulsory, and will not be sought through requisitioning. Among these are products whose cost was substantially above the 28 and 30 cents a pound maximums the government offers." To avoid misinterpretation as to the prices offered by the Copper Recovery Corporation for idle or excessive inventories of copper and copper base alloy products on December 14, 1942 the Materials Redistribution Branch of the WPB state: "that, if necessary, the government will requisition: 1. Any and all copper and copper base alloy products in primary form except those whose cost to the holder was substantially above the 28 and 30 cent maximums mentioned in the copper recovery price schedules, and 2. Any and all copper and copper base alloy fabricated products, except those which have been fabricated from primary forms whose cost to the holder was substantially above the 28 and 30 cent maximums mentioned in the copper recovery price schedules."

Enamel Ware Order Interpretation Interpretation No. 1 to Supplementary General Limitation Order L-30-b, dated November 24, 1942, reveals that the restrictions placed on the production of various types and kinds of enamel ware do not apply to military orders for use on shipboard or in the field. The interpretation also makes it clear that when one manufacturer fabricates the steel into black shapes and another applies the vitreous coating, both are considered to be using iron and steel under the quota provisions of the order. For this reason both must include the iron and steel involved under their individual quotas.

Formaldehyde Adjustable Pricing Adjustable pricing for the sale of formaldehyde, effective December 2, 1942, was established by OPA in the issuance on November 27, 1942 of Amendment No. 2 to Revised Price Schedule No. 21. Because a shifting of the cost situation with resulting changes in price structure and price regulation tended to make long term contracts risky transactions, under the terms of this amendment the seller and the buyer are permitted to agree to fix prices on delivery which are no higher than the maximum prices in effect at that time.

Generator and Motor Restrictions To stop the practice of applying for greater electric motor and generator capacity than is necessary, Conservation Order L-221, dated December 2, 1942, and effective December 10, 1942, prohibits the delivery or acceptance of motors or generators unless they comply with certain standard specifications of the simplest and most practical design. The purchaser must certify and give reasons why he must have a motor or generator of a special type. He must also certify that he made every reasonable effort (1) to adapt idle motors or generators in his possession, (2) to obtain used ones for his purposes, and (3) to repair or recondition his existing equipment. This order, it has been estimated, will result in an annual saving of 15,000,000 pounds of copper, 55,000 tons of carbon steel, and 150 000 pounds of stainless steel.

Gilding Metal Exempted The Office of Price Administration exempted gilding metal clad steel scrap from price control in the issuance on November 28, 1942 of Amendment No. 43 to Supplementary Regulation No. 1 to General Maximum Price Regulation No. 2. Gilding metal clad steel scrap is steel coated with an alloy of approximately 90 per cent of copper and 10 per cent of zinc which is being substituted for copper in the manufacturing of shell and cartridge cases.

Glycerine Control Tightened General Preference Order M-58, as amended December 10, 1942, tightened the control of glycerine by limiting deliveries to the amount of 1,150 pounds per month without specific WPB authorization. Under the amended order consumers of over 1,150 pounds per month must use Form PD-600 and suppliers must use Form PD-363-A revised.

Gold-Plate Prices Revised Sellers were granted permission to revise their pries upward on gold plate and gold-filled stock in the form of sheet, wire and tubing on November 26, 1942, retroactively effective as of September 3, 1942, by the issuance of Amendment No. 68 to Supplementary Regulation No. 141 to the General Maximum Price Regulation No. 2. This amendment permits prices to "be increased by 35.125 cents per fine troy ounce of newly-mined domestic silver contained in the product."

Government Publications Mailing Lists Representative Bartel J. Jonkman of Michigan introduced a bill (H. R. 7846) during the past month, which requires all agencies and departments of the executive branch of the government to reduce the number of names on the mailing lists for government publications. A similar bill may be introduced in the new Congress.

Graphite Under Complete Control Conservation Order M-61, as amended December 4, 1942, placed the distribution and use of graphite under complete control. The original order covered merely Madagascar graphite. The amended order extended this control to all domestic and imported graphite which will stand on a No. 50 mesh screen, U. S. Sieve Series.

Hard-Facing Elements Restricted For the purpose of saving such alloying hard facing elements as chromium, cobalt, molybdenum, nickel, tungsten and vanadium, all deliveries of such materials were limited by General Limitation Order L-223, dated December 2, 1942, to orders rated AA-5 or higher. An exception to this restriction is the use of

such elements up to one hundred pounds per month for research or field tests. Inventories of hard-facing elements are limited to a 60 days' supply. Producers must file monthly reports with the WPB on Forms PD-733, 734 and 735.

Heater Materials Restricted In an effort to save about 66 tons of nickel, 60 tons of copper, and 94 tons of zinc each year, Schedule III to Limitation Order L-164, dated November 21, 1942, prohibits the use of copper, copper base alloy, or alloys containing chromium, nickel or tin for tubing and tube sheets for feed water heaters. One exception to this order is the use of such materials needed to repair an actual breakdown, provided the replacement does not require more than 25 per cent of the tubing in the heater.

Industrial Equipment Certificate Required Limitation Order L-123 as amended November 23, 1942, and effective December 8, 1942, provides that buying orders for materials needed to maintain and repair industrial equipment must be accompanied by a certificate reciting the nature of the purchase.

Inorganic Acids Committee Meets Ways and means of assuring an adequate supply of sulfuric acid were discussed at the meeting of the Inorganic Acids Industry Advisory Committee on December 15, 1942. Particular consideration was given to the sulfuric acid supply situation on the West and Gulf Coasts. They also discussed the essential need of tank cars for the transporting of inorganic acids, the recovery of alkylation sludge acid, and the possibility of extending the use of hydrofluoric acid in the production of aviation gasoline.

Laboratory Fees May Be Added The OPA ruled on December 12, 1942 that it is permissible to add to the maximum price the fees charged by an independent laboratory to make assays or analyses of non-ferrous scrap if the laboratory is an impartial referee representing the interests of both buyer and seller.

Lamp and Shade Production Prohibited The production of portable electric lamps and shades containing critical materials was prohibited by General Limitation Order L-33 as amended December 10, 1942. This production restriction does not apply to lamps and shades for the Army, Maritime Commission, Navy, and War Shipping Administration.

Machine Price Increase Permitted Amendment No. 53 of Maximum Price Regulation No. 136, dated November 20, 1942, provides that the maximum prices of machines and parts containing silver may be increased 9.625 cents per fine troy ounce of silver content.

Manning Table Plan The War Manpower Commission and the Selective Service System have worked out jointly a Manning Table Plan which is said to have met with successful tests in seven large corporations. Briefly, this plan provides for (1) a listing of personnel requirements of war industries, (2) an orderly withdrawal of replaceable workers, (3) a method of replacing drafted workers, (4) a complete inventory of manpower needs, (5) a standardized classification of job titles, (6) draft deferment of men in essential positions, (7) a job description record system, and (8) a method of classifying workers into age, occupational, and domestic relations groups.

Servicing Prices The Office of Price Administration Amendment No. 9 to Maximum Price Regulation No. 165, dated November 23, 1942, granted permission to service businesses to either lower or raise their prices to the prevailing maximum effective prices if the sellers contract to furnish a continuing service to the buyers.

Nickel Plating Permitted Limitation Order L-114, as amended November 27, 1942, grants the use of nickel silver for pad inserts for nose pads on spectacle type goggles provided the nickel does not exceed 20 per cent of such alloy, for respirator valve inserts provided only 10 per cent nickel is in the alloy, for goggle frame and screw rivets provided the nickel content in the alloy does not exceed 18 per cent, and for end pieces and guard arms on spectacle type goggles provided the nickel content in the alloy is not in excess of 10 per cent. The amended order also permits "nickel plating for spectacle type goggles until, but not after, May 31, 1943."

Non-Ferrous OPA Branch Created Deputy Administrator J. K. Galbraith of the OPA announced on December 10, 1942 the consolidation of the Copper, Aluminum and Ferro-Alloys Branch and the Zinc, Lead and Tin Branch into the Non-Ferrous Metals Branch. John D. Sumner is the Price Executive of this branch. The heads of the five operating sections are O. C. Lockhard, Basic Metals and Mining; Donald Van Deusen, Ferro-Alloys; Philip Woolfson, Minerals and Minor Metals; Thomas McManus, Scrap and Secondary Metals, and Orrin McCorison, Fabricated and Manufactured Products.

Price Adjustment Rules The Office of Price Administration in Supplementary Order No. 28 dated November 19, 1942, set up new rules of procedure for employers who wish price adjustments based on wage or salary increases requiring the approval of the National War Labor Board. Here are some of the new rules. First, the request for price adjustment must be made before the proposed wage or salary increases go into effect. Second, the employer must file his price adjustment application within 15 days after the wage or salary increase petition was addressed to the National War Labor Board. Third, the application for such adjustment must be filed in accordance with the Revised Procedural Regulation No. 1 if the applicant is not a war contractor. Fourth, the application must be filed under Procedural Regulation No. 6 if the applicant is working on a government contract, or if he is a subcontractor for certain war commodities or services. Fifth, the applicant must supply OPA with a copy of his latest balance sheet, a copy of his profit and loss statement for the last quarterly period or most recent period, and a statement showing the effect of the wage or salary increases on the total sales and other costs.

Production Requirements Plan Changes To facilitate an easy transition from the Production Requirements Plan to the Controlled Materials Plan, A. J. Krug, Deputy Director General for Distribution, has made certain changes in authorizing the purchase of aluminum, copper, magnesium and steel during the first quarter of 1943. For example, manufacturers requiring aluminum and magnesium mill shaped products as listed on Form PD-25A must now place their orders with the mills who will apply to the WPB's Aluminum and Magnesium Division for approval.

Silver Stock and Value There are 3,000,000,000 ounces of silver at West Point. About 1,500,000,000 ounces are held in security for the one dollar silver certificates in circulation. To this stock of silver more is to be added because all worn and uncurrent standard silver dollars now held or received by the Treasury Department are to be melted down into bars. The silver dollar, which contains 371.25 grains of silver, and circulates at a nominal value of one dollar, has an actual value, in terms of the new gold dollar, of 27 cents.

Small Business Reports Simplified

Office of Price Administration Supplementary Order No. 30, issued on November 25, 1942, has simplified the forms which must be used by owners of service establishments doing an annual business of $25,000 or less. Form OPA2PR3 (a) may be used for price adjustments for services covered by Section 1499.114 (a) of Maximum Price Regulation No. 165 as amended and pursuant to Section 1499.18 (o) of the General Maximum Price Regulation. And Form OPA2PR3 (b) may be used for price adjustments for services covered by Section 1499.114 (b) of Maximum Price Regulation No. 165 as amended.

Specialists Wanted

The War Manpower Commission is urging all college seniors and graduate students of chemistry, physics, engineering, and other specialized fields to register their skill with Dr. Leonard Carmichael, Director, National Roster of Scientific and Specialized Personnel, War Manpower Commission, Washington, D. C. This request is being made because of the increasing demand for technically-trained personnel both by the government and by private industry.

Steel Drum Prices

Amendment No. 1 of OPA Revised Price Schedule No. 43, dated December 14, 1942, established a maximum price of $35.00 each for reconditioned 55-gallon stainless steel drums which manufacturers can no longer use because of war regulations. These drums which are made of 16-gauge steel with 18 per cent chromium and 8 per cent nickel alloy, originally cost from $33.75 to $40.00. The prevailing price for new drums, when obtainable, is $46.50 each.

Sulfamic Acid Order Amended

Sulfamic Acid and Sulfamic Acid Derivatives General Preference Order M-242, which among other things relates to the distribution and consumption of such chemicals for electroplating solutions, for peptizing pigments, and for other uses, was amended on December 12, 1942, to provide for the delivery to any one person, without specific authorization during any calendar month, five pounds or less of sulfanic acid or sulfamic acid derivatives for analytical, testing, control, educational or research purposes. But no producer or distributor is permitted to deliver for such purposes more than a total of 100 pounds of those chemicals during any calendar month.

SWP Division Contract Placements

The Smaller War Plants Division of the WPB announced on December 3, 1942 that for the period since its creation up to November 27, 1942, it placed 58 prime contracts to the amount of $21,000,000. It also made known that since the creation of the Smaller War Plants Corporation in June, 1942, to November 27, 1942, inclusive, it has granted a total of 15 loans whose total amounts to $1,054,500. Congress provided this corporation with $150,000,000 to loan to small business.

Tin Oxide Restrictions

The use and manufacture of tin oxide was restricted further by Conservation Order M-43-a as amended November 24, 1942. On December 1, 1942, the use of tin for coating foundry chaplets was limited to 5 per cent tin content of the total weight. Unless especially provided for in this order, tin cannot be used in the manufacturing or processing of such items as advertising specialties, art objects, Britannia metal, broom wire, buckles, chimes and bells, fasteners, foil, jewelry, household and kitchen equipment, pewter and pewter hollow ware. These restrictions also apply to the use of tin for galvanizing articles, and plating and coating for decorative purposes.

Tinplate, Terneplate Order Amended

Conservation Order M-81, as amended December 9, 1942, fixed the amount of tin and steel which can be used for cans in 1943. This amended order (1) establishes packing quotas for hundreds of food products and non-food commodities; (2) specifies the sizes of cans for different commodities; (3) states the tin content limits of cans for different uses, and (4) specifies if tinplate, terneplate or blackplate may be used for can materials for both body and/or ends of a can.

Transportation Tax Ruling

The Office of Price Administration ruled on November 22, 1942 that the three per cent property transportation tax imposed under the 1942 Revenue Act, effective December 1, 1942, cannot be passed on to the buyer if the goods are bought on a "delivered price" basis; but, if the goods are bought on an "f.o.b. producer's establishment" basis, it is permissible to pass the tax onto the buyer.

Tungsten Order Amended

All supplies of tungsten powder, rod, sheet and wire were placed under complete control by General Preference Order M-20 as amended November 27, 1942. This order applies to all non-ferrous mixtures or alloys containing tungsten.

Zinc Plated Coins Coming

Zinc plated steel coins, in denominations of one cent, three cents and five cents will be in circulation in 1943. The present copper cents and nickels will be withdrawn from circulation. The present cents will be melted down to recover nearly 1,000,000 pounds of copper. The present five cents coins which contain 56 per cent copper, 9 per cent electrolytic manganese and 35 per cent silver will be melted down to recover these metals for more essential uses.

Zinc Product Price Changes

To prevent unwarranted price increases, Amendment No. 1 to Maximum Price Regulation No. 124, dated December 3, 1942, provides that by January 3, 1943, all producers of rolled zinc products must file with the OPA a report showing: "(i) The types of rolled zinc products he produced during the period October 1, 1940 to November 1, 1942; (ii) The extra charges which he had in effect on October 1, 1941, for each type of rolled zinc product produced; and (iii)Cash and trade discounts in effect for each class of purchaser on October 1, 1941. Extra charges, not in excess of those prevailing on October 1, 1941, are permitted for special gauge, particular shapes and types of packing, and special grades or finishes of products containing 95% or more of zinc.

Zinc Usage Restricted

Because of the critical shortage of zinc, Conservation Order M-11-b as amended November 26, 1942, has restricted further the uses of zinc. For example, the new restrictions on plating and protective coating (including galvanizing), provide that no item on lists "A" and "A-1" of the order, such as artcraft articles, beauty and barber shop equipment, burial equipment, clock and watch cases, gaming and vending machines, cooking appliances and novelties, are permitted to be made of metal coated with zinc. For the first calendar quarter in 1943, the use of zinc for automotive and tractor carburetors and fuel pumps for repair and maintenance purposes, was reduced to 50 per cent of the amount consumed during the third calendar quarter of 1942.

Dictionary of Metal Finishing Chemicals

We present herewith the first installment of a dictionary of chemicals applicable particularly to the metal finishing industry. This feature will run regularly in *Metal Finishing* until the dictionary is complete.

Abel's Reagent: 10% solution of chromic acid. Used as an etchant for microscopic examination.

Abyssinian Gold: Imitation gold alloy. Also known as Talmi Gold. Contains approximately 91% Cu, 8% Zn or 86% Cu, 12% Zn, 1% Sn.

Acacia Gum: Gum arabic. White granules and powder. Grades: Technical, U. S. P. Containers: Bags (1, 5, 10, 25, 200 lb.); Wooden kegs (100 lb.); Barrels (300 lb.).

Acetaldehyde: CH_3CHO. Mol. Wt. 44.052. Sp. gr. 0.7834. M. P.—123.5° C. B. P. 21° C. Colorless, flammable liquid. Infinitely soluble in water, alcohol, benzene, gasoline, acetone, turpentine. Grades: Technical, Purified. Containers: Bottles (1 oz., ¼ lb., 1 lb.); Cans (1 lb.); Drums (1, 5, 10, 55, 110 gal.) Tank cars.

Acetate of Lime: See Calcium Acetate.

Acetic Acid: CH_3COOH. Mol. Wt. 60.052. Sp. gr. 1.049. M. P. 16.6° C. B. P. 118.1° C. Colorless liquid. Also known as Vinegar Acid. Infinitely soluble in water, alcohol. Grades: Technical, U. S. P., C. P. Concentrations: 28%, 30%, 36%, redistilled 56%, 60%, 80%, 90%. Containers: Bottles (1, 5 lb.); Carboys 40-50, 100, 110 lb.); Barrels (400-450 lb.).

Acetic Acid Glacial: See Acetic Acid. Sp. gr. 1.0553. Grades: Technical, U. S. P., C. P. Concentrations: 80%, 90%, 99.5%, 99.9%. Containers: Bottles (1, 5 lb.); Carboys (45, 100 lb.); barrels (400-450 lb.).

Acetic Ester: See Ethyl Acetate.

Acetic Ether: See Ethyl Acetate.

Acetone: CH_3COCH_3. Mol. Wt. 58.078. Sp. gr. 0.792. M. P.—95° C. B. P. 56.5° C. Colorless, flammable liquid. Also known as Dimethyl Ketal, Dimethyl Ketone. Infinitely soluble in water, alcohol, ether, most volatile oils. Grades: Technical, U. S. P., C. P. Containers: Bottles (1, 5 lb.); Cans (1, 5, 7, 33, 35 lb.); Drums (70, 330-350, 650, 700 lb.); Barrels (350 lb.). Tank cars.

Acetone Alcohol: See Methyl Alcohol.

Acid of Sugar: See Oxalic Acid.

Admiralty Metal: Alloy containing 70% Cu, 29% Zn, 1% Sn.

Albolene: See Petrolatum, Liquid.

Albumen, Egg: White powder or scales. Soluble in water. Grades: Technical. Containers: Bottles (1 lb.); Boxes, tins (1, 5, 10, 25, 100 lb.); Kegs (100 lb.); Cases (150, 200, 225 lb.); Drums (200 lb.).

Alcohol: See Ethyl Alcohol.

Alcohol, Denatured: See Denatured Alcohol.

Alcohol, Grain: See Ethyl Alcohol.

Alcohol, Wood: See Methyl Alcohol.

Alkali Metals: Lithium, sodium, potassium, rubidium, cesium.

Alkaline Earth Metals: Barium, calcium, strontium.

Aloxite: Brand of aluminum oxide; q. v. used for abrasive purposes.

Alphadimethylglyoxime: See Dimethylglyoxime.

Alum: Double sulfate of aluminum and other metal but usually refers to aluminum potassium sulfate or potash alum.

Alumina: See Aluminum Oxide.

Alumina, Activated: A form of aluminum oxide, q. v. with great adsorptive powers.

Aluminum: Al. Mol. Wt. 26.97. Sp. gr. 2.70. M. P. 659.7° C. Silver white, ductile metal. Soluble in alkalis, hydrochloric acid, sulfuric acid. Insoluble in nitric acid, acetic acid, ammonia. Grades: Technical, C. P. Dust, Foil, Granular 8-16 mesh, 20 mesh, 30 mesh, Flakes, Rods, Sheet, Sticks, Turnings, Wire. Containers: Cans, Cartons, Papers (1, 5 lb.); Tins (25 lb.).

Aluminum Ammonium Sulfate: $Al_2(SO_4)_3(NH_4)_2SO_4 \cdot 24H_2O$. Mol. Wt. 906.64. Sp. gr. 1.6. M. P. 93.5° C. Loses water of crystallization at 120° C. Colorless crystals, white powder, lumps, or granules. Solubility in cold water—15. Infinitely soluble in hot water. Also known as Ammonia Alum and Burnt Alum. Grades: Technical, U. S. P., C. P. Containers: Bottles and Tins (1, 5 lb.); Boxes (25 lb.); Drums (100 lb.); Kegs (100, 112 lb.); Bags (200 lb.); Barrels (250, 275, 300, 330, 350, 375, 400 lb.); also sold in bulk.

Aluminum Bromide: $AlBr_3 \cdot 6H_2O$. Mol. Wt. 374.81. Sp. gr. 2.54. M. P. 93° C. Colorless or yellowish deliquescent needles. Soluble in cold water, alcohol. Decomposes in hot water. Grades: Technical, C. P. Containers: Glass vials (1 oz., 1 lb.). Tight sealed drums.

Aluminum Chloride: $AlCl_3$ and $AlCl_3 \cdot 6H_2O$. a) Anhydrous. Mol. Wt. 133.34. Sp. gr. 2.44. Sublimes when heated. White-colorless hexagonal crystals; very deliquescent. Solubility in cold water 70. Decomposes slightly in hot water. b) Hydrate. Mol. Wt. 241.44. Colorless, trigonal crystals; very deliquescent. Soluble in cold water. Very soluble in hot water, evolving hydrogen chloride. Decomposes when heated. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Tins (5, 25 lb.); Kegs, Airtight drums (100 lb.).

Aluminum Fluoride: AlF_3. Mol. Wt. 83.97. Sp. gr. 3.07. M. P. 1040° C. Fine, triclinical colorless to white crystals. Soluble in cold and hot water. Insoluble in acids, alkalis, alcohol. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Cartons (10 lb.); Kegs and Boxes (25, 50, 100 lb.); Barrels.

Abbreviations: Mol. Wt. = Molecular Weight; Sp. gr. = Specific Gravity; M. P. = Melting Pont; B. P. = Boiling Point; Solubility figures, where given, are parts by weight in 100 parts of water.

Aluminum Hydroxide: $Al(OH)_3$. Mol. Wt. 77.99 or $Al_2O_3 \cdot 3H_2O$. Mol. Wt. 132.04. Sp. gr. 2.42. White powder or gelatinous precipitate. Insoluble in water, alcohol. Soluble in acids, alkalis. Grades: Technical, U. S. P., C. P. Containers: Bottles (1 lb.); Cartons (5 lb.); Boxes, Kegs (25, 50, 100 lb.); Barrels (90, 100, 200, 300, 400 lb.); Drums (100 lb.).

Aluminum Oxide: Al_2O_3. Mol. Wt. 101.94. Sp. gr. 3.5-4.0 M. P. 2050° C. Also known as Alumina. Hexagonal, colorless, fine, hard crystals, white powder or lumps. Insoluble in water. Very slightly soluble in acids and alkalis. Soluble in hot sulfuric acid. Grades: Technical, C. P. Containers: Cans (1, 5, 10, 25, 50, 100 lb.); Bottles, Cartons (1, 5 lb.); Drums (100, 300); Barrels.

Aluminum Potassium Sulfate: $Al_2(SO_4)_3K_2SO_4 \cdot 24H_2O$). Mol. Wt. 948.76. Sp. gr. 1.75. M. P. 105° C. Also known as Potash Alum, Burnt Alum. Small, colorless to white crystals, white lumps or powder, granules. Solubility in cold water 11.5. Infinitely soluble in hot water. Soluble in dilute acids. Grades: Technical, U. S. P., C. P., Lump, Crystals, Powder. Containers: Bottles, Cartons (1, 5 lb.); Tins (1, 5, 25 lb.); Drums (25, 100 lb.); Kegs (100 lb.); Bags (200 lb.); Barrels (300, 350, 400, 410 lb.).

Aluminum Sodium Sulfate: $Al_2(SO_4)_3 \cdot Na_2SO_4 \cdot 24H_2O$). Mol. Wt. 916.56. Sp. gr. 1.675. M. P. 61° C. Also known as Soda Alum. Colorless crystals. Very soluble in water, soluble in dilute acids. Decomposes in hot water. Grades: Technical, C. P. Containers: Bottles, Cartons (1, 5 lb.); Tins (25 lb.). Bags (200 lb.); Barrels (350, 400 lb.).

Aluminum Sulfate: $Al_2(SO_4)_3 \cdot 18H_2O$. Mol. Wt. 666.4. Sp. gr. 1.69. Also known as Alum, Pearl Alum, Pickle Alum. Monoclinic white crystals, lumps, granules; white powder when dehydrated to the anhydrous state. Decomposes when heated. Soluble in water. Grades; Technical—low iron, U. S. P., C. P., N. F. Containers: Bottles (1, 5 lb.); Cartons (1, 5, 10, 25, 50 lb.); Kegs (100 lb.); Barrels (200, 300, 350, 400 lb.).

Alundum: Brand of aluminum oxide abrasive.

Ammonia: Technically NH_3 gas which is usually known as Anhydrous Ammonia. Commonly a solution of NH_3 gas in water. See Ammonium Hydroxide.

Ammonia Alum: See Aluminum Ammonium Sulfate.

Ammonia, Anhydrous: NH_3. Mol. Wt. 17.032. M. P.—77.7° C. B. P.—33.4° C. Also known as ammonia gas and liquid ammonia when liquified by pressure. Solubility in water 90 at 0° C., 7.4 at 100° C. Grades: Technical, purified. Containers: Steel cylinders (7 oz., 2½, 5, 17, 45, 50, 100 lb.); Tanks.

Ammonia, Aqua: See Ammonium Hydroxide.

Ammonia, Crystal: See Ammonium Carbonate.

Ammonia, Liquid: See Ammonia, Anhydrous.

Ammonioferric Citrate: See Ferric Ammonium Citrate.

Ammonium Acetate: $NH_4C_2H_3O_2$. Mol. Wt. 77.084. Sp. gr. 1.073. M. P. 114° C. White crystals, hygroscopic. Solubility in water 148 at 4° C. Decomposes in hot water. Grades: Technical, Purified. U. S. P., C. P. Containers: Bottles (1, 5 lb.); Boxes (25 lb.); Drums (100 lb.); Kegs (125 lb.); Barrels (400, 450 lb.).

Ammonium Bicarbonate: NH_4HCO_3. Mol. Wt. 79.058. Sp. gr. 1.58. Colorless or white crystals. Solubility in water 11.9 at 0° C. Decomposes in hot water and when heated. Grades: Technical, Purified, C. P. Containers: Bottles (1, 5 lb.); Boxes (25 lb.); Kegs and drums (100 lb.); Barrels (300, 325, 410 lb.).

Ammonium Bichromate: See Ammonium Dichromate.

Ammonium Bifluoride: NH_4HF_2. Mol. Wt. 57.05. Sp. gr. 1.21. White powder and deliquescent crystals. Soluble in cold water. Decomposes in hot water. Grades: Technical, Purified. Containers: Waxed glass bottles (1 lb); Boxes (10, 50 lb.); Drums (100, 250 lb.); Kegs (100 lb.); Casks (110, 220 lb.); Barrels (300, 350, 450 lb.).

Ammonium Binoxalate: $NH_4HC_2O_4 \cdot H_2O$. Mol. Wt. 125.084. Sp. gr. 1.556. Colorless, rhombic crystals. Soluble in water. Decomposes when heated. Grades: Technical, Purified, C. P. Containers: Bottles (1, 5 lb.).

Ammonium Bisulfate: NH_4HSO_4. Mol. Wt. 115.11. Sp. gr. 1.78. M. P. 147° C. White rhombic crystals. Solubility in cold water 100. Very soluble in hot water. Grades: Technical, Purified, C. P. Containers: Bottles (1, 5 lb.).

Ammonium Fluoride: NH_4F. Mol. Wt. 37.04. Colorless or white deliquescent crystals. Very soluble in cold water. Decomposes in hot water.

Ammonium Carbonate: The article of commerce is a mixture of ammonium and ammonium carbamate having the formula: $NH_4HCO_3 \cdot NH_4NH_2CO_2$. Colorless crystals, lumps, cubes, powder. Also known as Crystal Ammonia, Hartshorn. Decomposes in air to ammonium bicarbonate. Soluble in cold water. Decomposes in hot water liberating ammonia. Grades: Technical, U. S. P., C. P. Containers: Bottles (1, 5 lb.); Cans, Kegs, Boxes (5, 10, 25 lb.); Drums (100 lb.); Barrels (200, 350, 360, 450, 475, 500, 560, 650 lb.); Casks (500, 551 lb.).

Ammonium Chloride: NH_4Cl. Mol. Wt. 53.497. Sp. gr. 1.54. Decomposes when heated to 350° C. Sublimes at 520° C. Colorless or white cubic or fibrous crystals. Also known as Salammoniac and Ammonium Muriate. Solubility in water 29.7 at 0° C. and 75.8 at 100° C. Grades: Technical, Purified, U. S. P., C. P. Granulated, Lump. Containers: Bottles, Cans (1, 5 lb.); Kegs, Boxes, Cans (25 lb.); Kegs (50, 100, 125 lb.); Drums (100 lb.); Barrels (200, 212, 250, 275, 300, 330, 350, 375, 560 lb.); Casks (500, 551, 560, 700, 880 lb.).

Ammonium Chloropalladite: $(NH_4)_2PdCl_4$. Mol. Wt. 284.6. Sp. gr. 2.17. Tetragonal olive green prisms. Decomposes when heated. Soluble in water. Insoluble in alcohol.

Ammonium Chloroplatinate: $(NH_2)_4PtCl_6$. Mol. Wt. 444.05. Sp. gr. 3.07. Yellow, cubical crystals. Also known as Ammonium Platinichloride and Platinum Ammonium Chloride. Soluble in water. Decomposes when heated. Grades: Technical. Containers: Bottles.

Ammonium Chromate: $(NH_4)_2CrO_4$. Mol. Wt. 152.09. Sp. gr. 1.91. Yellow crystals. Solubility in water 40.5 at 30° C. Decomposes in hot water. Grades: Technical, Purified, C. P. Containers: Bottles (1, 5, lb.); Boxes, Barrels.

Ammonium Dichromate: $(NH_4)_2Cr_2O_7$. Mol. Wt. 252.10. Sp. gr. 2.15. Orange crystals. Also known as Ammonium Bichromate. Solubility in water 30.8 at 15° C. Grades: Technical, Purified, C. P., Crystal, Granulated for photo. Containers: Bottles, Cartons (1, 5 lb.); Boxes and cartons (25 lb.); Kegs (100 lb.); Drums (100, 400 lb.); Barrels (250 lb.).

Ammonium Dihydrogen Phosphate: See Ammonium Phosphate-Mono.

(To be continued next month)

Abbreviations: Mol. Wt. = Molecular Weight; Sp. gr. = Specific Gravity; M. P. = Melting Pont; B. P. = Boiling Point; Solubility figures, where given, are parts by weight in 100 parts of water.

PLATING AND FINISHING
POLISHING — BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

SHOP PROBLEMS

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. The questions this month are answered by G. B. Hogaboom, Jr., and Nathaniel Hall. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Preparation of High Speed Steel Prior to Hard Chromium Plating

Question: What is a good method for preparing a surface of high speed steel or high carbon steel prior to the deposition of hard chromium? Please give specific operations necessary to insure good adherence of the hard chromium and eliminate the possibility of passive spots which sometimes result.—H. N.

Answer: As far as we know, high speed steel and high carbon steel are treated in the usual manner prior to hard chromium plating, namely—cleaning with alkali, rinsing, acid dipping and anodic etching either in sulfuric or chromic acid.

Some alloy steels occasionally give trouble with passive spots. In such cases, it is general practice to eliminate the reverse current treatment. The article, after cleaning, is dipped in a very strong solution of hydrochloric acid, such as 11, rinsed and plated.

Tarnishing of Silver

Question: We are doing a great deal of silver plating for the Signal Corps and though none of our plating has been rejected, we find that our silver tarnishes.

We have had our plating tested and it stands up under all salt spray tests. We would like to know if this tarnishing of silver is universal.—H. N., Inc.

Answer: Tarnishing of silver is universal, since this metal is particularly sensitive to minute amounts of sulfur in the atmosphere. The use of a small amount of neutral soap flakes in the final hot water rinse will minimize this condition.

Plating Zinc Base Die Castings

Question: These questions concern a radio plug connector made of zinc base die cast material. If this piece were silver plated and then fastened to an aluminum panel on the radio chassis, would an electrolytic action take effect to harm the silver or aluminum? Could this zinc base die casting be cadmium plated and mounted on an aluminum panel or should the zinc base die casting be copper plated and then cadmium plated before assembly? Would a copper nickel coating on this zinc die casting be satisfactory? Will you kindly advise us which or how many of these coatings would be satisfactory on this kind of a set-up?—Y. E.-P. Co.

Answer: In our past experience with silver plated zinc die castings in the salt spray, we have observed a tendency for the zinc to corrode very seriously through the pores of the deposit resulting in a badly pitted appearance.

The type of electrolytic action will, of course, depend on the conditions of exposure since, as you know, aluminum is not very resistant to chloride atmospheres or high alkaline conditions since they tend to destroy the naturally formed oxide film. Since the oxide film on aluminum is quite resistant and is self-healing, we imagine that it would be cathodic to the other materials which might be placed in contact with it. We would expect that, in view of the difficulty of obtaining an absolutely pore-free deposit on the zinc die castings, any attack which might occur would be on the zinc rather than on the aluminum. It is suggested that test couples be prepared in order to determine the exact effect.

Silvering Watch Dials

Question: We are owners of a new dial refinishing plant. We have tried various methods of silver plating, such as using silver paste, electroplating, dipping, etc.; however, the dials don't acquire that heavy pale-white color they get in a refinishing plant.

Can you suggest any method we might employ successfully?—F. & Son.

Answer: We submit herewith two formulas for silvering watch dials:

1. Silver chloride ..... 4 parts
   Cream of Tartar ..... 8 "
   Sodium chloride ..... 1 part

2. Precipitated silver ..... 1 part
   Cream of Tartar ..... 2 parts
   Sodium chloride ..... 2 "

The ingredients are mixed with a small amount of water to a paste consistency and applied with a stiff brush using a rotary motion.

Solution for Resharpening Steel Files

Question: We have been trying to resharpen steel files and band saw blades by treating them in various acid solutions. To date we have had no success at all.

We would greatly appreciate any information you can give us on this matter.—R. A. N. Co.

Answer: A formula recommended for resharpening steel files after removing oil with solvent is to immerse them for 20 to 25 minutes at room temperature in a solution composed of the following:

Sulfuric acid	7 oz.
Copper sulfate	2 oz.
Borax	2 oz.
Water	1 pt.

Remove the smut with a wire brush.

It is suggested that if large quantities of files are used, consideration be given to chromium plating before use. The chromium deposit is stripped before it is worn off and the file is then replated. In this way greatly increased life results.

Army and Navy Specifications

Question: How can we obtain army and navy specifications for electroplating?—M. P. Corp.

Answer: Army specifications for electroplating may be secured from The Chief, Materiel Division, Air Corps, Wright Field, Dayton, Ohio. Navy specifications may be obtained from the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.

Recovery of Silver

Question: I am doing a large volume of silver plating work. I do all my silver stripping with a hot sulfuric acid strip. For the past year and a half I have been reclaiming the silver myself by the following method.

When my strip became impoverished, I added water and salt until a chloride was formed. Then I washed it several times to get all the acid out. I then drained as much water out as possible; then added muriatic acid and gradually some metallic zinc until a mud-like consistency was formed. Another wash to get all the acid and zinc out followed. After drying, I put it into a crucible and melted it down into silver anodes. I usually got 250 to 300 ounces of silver. My problem is I can't get metallic zinc now and I would like to know if there is something else I could use to obtain the same results.—A. L.

Answer: We suggest that you recover the silver electrolytically.

You can do this by dissolving the silver chloride precipitate in sodium cyanide. This should be done under a hood or out in the open if the acid has not been washed out completely, since the reaction between any residual acid and the cyanide will result in the evolution of hydrocyanic acid fumes which are highly poisonous.

The silver can be plated out on thin sheets of silver or on steel using steel or carbon anodes and can then be remelted as you are doing at present.

We suggest that you use eight ounces of sodium cyanide for each gallon of final solution. When all, or most of the silver has been plated out, the cyanide solution can be used to dissolve more silver chloride precipitate and it will be necessary to make only occasional additions of sodium cyanide to balance decomposition losses.

Platinum Anodes

Question: We are contemplating the use of platinum as insoluble anode material in some of our alkaline plating solutions. We would like to plate these anodes in our own plant. Will you please send us any information you care to offer on the use of electroplated platinum vs. platinum clad material. We would also like to have information as to the plating solution and the conditions to be used for plating a deposit thick enough to be free from base metal effects.—W. A. Corp.

Answer: Platinum deposits are porous and a deposit would have to be particularly thick to avoid this condition.

There are various proprietary platinum solutions on the market and solutions can also be made up according to the procedures given in the 1942 *Plating and Finishing Guidebook.* However, we do not believe it would be possible to plate deposits of sufficient thickness to be free from base metal effects.

We suggest that you consider the advisability of using a platinum clad material.

Fe, S and O in Chromium Solutions

Question: We should appreciate any data you may have regarding the harmful effects of iron, sulfur and oxygen under one per cent in hard chromium plating solutions.—U. A. P., Inc.

Answer: We do not have any information on the effect of oxygen in hard chromium plating solutions but we do not believe that there will be any harmful effect inasmuch as there is considerable evolution of oxygen at the anode in ordinary plating.

Sulfur, if present in the solution, would eventually be combined to sulfate. Any harmful effect of the sulfur would be a function of the variation in sulfate ratio above that desired.

Iron under one per cent would probably not be harmful. The effect of iron is to combine with the chromate to form ferric dichromate which is only slightly ionizable. The net result is that the effective concentration of chromic acid decreases as does the conductivity of the solution. With 1 oz./gal. of iron present, the cathode efficiency will be below 8 per cent.

The Magne-Gage Method

Question: Can you give me any information on the "Magne-Gage" method?—L. K.

Answer: For data on the "Magne-Gage" method, we suggest your writing the American Instrument Company, 8015 Georgia Ave., Silver Spring, Maryland, and asking them to send you a copy of their literature on the instrument.

Plating Small Holes

Question: I have a piece with a hole in it, about 5/16″ deep and 5/16″ in diameter. It is desired to chromium plate the hole only to a thickness of 0.002″ on the radius.

I am using a 53 oz./gal. solution of 100-1 sulfate ratio, at a temperature of 125-131° F., with a current density of 2.0 amp./sq. in. When I first tried some of these pieces, I used steel anodes which promptly disintegrated, but which gave me a bright plate. Since I replaced the anodes with 60-40 solder (lead wire being unobtainable) I have been obtaining a duller plate and although hard, it is a brittle plate which seems porous upon fracture.

Can you tell me: (1) Whether the solder wire (about 3/32″ diameter) is affecting the plate? (The piece is all stopped-off). (2) Whether I am using the right temperature, current density, concentration, etc., for a fairly bright, ductile plate? (The plate is partly ground and honed but must not break away from the edges of the hole during and after these operations). (3) What is the best relation between the anode diameter and the hole diameter? (4) Shall I use steel wires and lead plate them? Can I use an alkaline plating solution for this? —A. S. Corp.

Answer: There may be some possibility of the tin content of the solder depositing on the article as metastannic acid or some other colloidal tin compound. In plating holes of such small diameter we advise the use of platinum wire which is relatively inexpensive considering the small amount required. We suggest that you use a 33 oz. solution at a temperature between 130-140° F. instead of the 53 oz. solution at the lower temperature. The current density being used is satisfactory.

It is more important to have proper centering of the anode in the hole than adjustment of the ratio between the anode and hole diameters.

Patents

Vitreous Coating

U. S. Pat. 2,301,741. W. C. Morris, assignor to Poor & Co., Nov. 10, 1942. In the process of enamel-coating ferrous metals, the new step of applying to the metal sheet a self-bonding milled slip containing a metallic boro-silicate having a fusing point in the range of 1,000°-1260° F. and a solution of ferric sulfate decomposable below the fusion temperature of the glass.

Nickel Anode

U. S. Pat. 2,304,059. C. G. Bieber and H. E. Tschop, assignors to The International Nickel Co., Inc., Dec. 8, 1942. An improved nickel anode comprising 0.20-0.30% carbon, 0.007-0.010% sulfur, 0.20-0.25% silicon, 0.05-0.07% magnesium, not more than 0.10% copper, not more than 0.01% manganese, not more than 0.10% iron and the balance principally nickel, said anode having increased activity, more uniform corrosion, a greater sludge adherence and a lesser tendency to produce loose nickel than conventional carbon-containing nickel anodes. The patent details the purpose of each addition to the nickel anode.

Hot Tinning

U. S. Pat. 2,304,069. G. J. Beckwith, assignor to The American Steel & Wire Co., Dec. 8, 1942. In a continuous process of hot tinning cold rolled steel strip, the steps including cathodically cleaning the strip in a hot caustic solution, rinsing, anodically etching the strip in a nitric acid bath of 3-10% concentration at a temperature up to about 175° F. and at a current density of from about 50-100 amp./sq.ft., deoxidizing the etched strip in a flux containing muriatic acid, coating with molten tin and wiping the tin coated strip under a pressure of from about 100 to 1,000 lb./sq. in.

Plating Non-Conductors

U. S. Pat. 2,304,182. H. M. Lang, assignor to Sigmund Cohn, Dec. 8, 1942. Forming of an electrolytically deposited reflecting surface by decomposing nickel carbonyl on the non-conducting surface and then electroplating.

Cleaning Strip

U. S. Pat. 2,304,432. F. J. Wood, assignor to Goodman Mfg. Co., Dec. 8, 1942. A push-through pull-through machine for continuously pickling and cleaning heavy and light gauge strip metal.

Electroforming

U. S. Pat. 2,305,050. E. M. Wise and R. F. Vines, assignors to The International Nickel Co., Inc., Dec. 15, 1942. A process for preparing electroformed reflectors.

Insoluble Anode

U. S. Pat. 2,305,133. T. A. Campbell, assignor to Chile Exploration Co., Dec. 15, 1942. An insoluble anode for copper electrorefining from an electrolyte containing nitric acid, which corrodes ordinary lead anodes, comprising an alloy of lead plus about 9-18% antimony and silver in an amount in excess of 0.5% by weight of the anode.

Hot Dipping Alloy

U. S. Pat. 2,298,237. A. A. Smith, Jr. and P. A. Beck, assignors to American Smelting & Refining Co., Oct. 6, 1942. An alloy for coating a ferrous metal, consisting of 0.2-3% antimony, 0.2-5% zinc, 2-7% tin and balance lead.

Example:

Tin	5%
Zinc	2%
Antimony	1%
Lead	92%

Phosphate Coating

U. S. Pat. 2,298,280. W. J. Clifford and H. H. Adams, assignors to Parker Rust-Proof Co., Oct. 13, 1942. A coating solution containing a coating acid phosphate and hydroxylamine in an amount that accelerates the coating action of the solution.

Example for steel:

Immerse in N/5 solution of zinc or manganese dihydrogen phosphate (determined by phenolphthalein) containing 0.4% of hydroxylamine at a temperature of 15° to 80° C.

Corrosion Prevention of Iron and Steel

U. S. Pat. 2,298,312. G. C. Romig, assignor to American Chemical Paint Co., Oct. 13, 1942. A method of coating ferrous metal surfaces with a water insoluble phosphate by treating them with an acid zinc phosphate solution, after first cleaning the surfaces by washing them with an alkaline cleaner in which is emulsified a solvent oil chosen from the class consisting of dead oil, anthracene oil, creosote oil, pine oil and high flash coal tar naphtha.

Example of Emulsion:

1.	Pine oil	0.850 gal./gal.
	Fish oil rosin soap	0.600 lb./gal.
2.	Dead oil	0.627 gal.
	Oleic acid	0.052 "
	Triethanolamine	0.021 "
	Water	0.300 "
3.	High flash coal tar naphtha	0.600 gal.
	50% caustic soda solution	0.012 "
	Water	0.338 "

One of the above concentrated emulsions is added to water or to an alkaline cleaner in the proportion of about ⅓ to 3 gal. per 100 gal. of water or cleaner.

Example of Phosphate Bath:

Zinc (as dihydrogen phosphate)	0.144-0.288%
Hydrogen peroxide	0.0044-0.0117%

Supersaturation is maintained by adding 0.7 to 1.1 lb. of caustic soda for every pound of zinc added as a concentrated zinc phosphate solution.

Corrosion Prevention of Metals

U. S. Pat. 2,298,513. H. E. Rogers, assignor to Teletype Corp., Oct. 13, 1942. A process of coating metallic parts to prevent tarnish or oxidation which consists in dissolving lanolin in trichlorethylene in the proportion of from 12 to 20% by weight, heating the solution in an open top vessel to a temperature of from 150° to 190° F., cooling the vapors overlying the solution to subdue evaporation, immersing the parts in said solution for a period of from 15 to 30 seconds according to the mass of the parts, and withdrawing the parts by moving them upwardly rapidly through the subdued evaporation zone overlying the solution.

Coating for Rubber Adherence

U. S. Pat. 2,296,838. E. C. Domm, assignor to National-Standard Co., Sept. 29, 1942. An article designed for adherent vulcanization of rubber thereto comprising a metallic base, a metal of the class consisting of zinc, cadmium, lead and tin thereon and a coating of a metal of the class consisting of nickel and cobalt of a thickness of approximately 1/30000 to 1/400000 of an inch on the zinc.

Cleaning Nickel

U. S. Pat. 2,299,054. W. J. Harshaw and K. E. Long, assignors to The Harshaw Co., Oct. 13, 1942. In an electroplating process, the steps of producing a bright electrodeposit of nickel containing a minor amount of a codeposited element of the class consisting of selenium and tellurium and preparing the said deposit for plating with another metal by a process including the step of making said deposit cathode in an aqueous bath essentially of an aqueous solution of sodium cyanide. The article may be made anode first for not more than 10 seconds before making it cathode. The solution may also contain sodium carbonate and sodium formate.

Example:

1.	Sodium cyanide	8 oz./gal.
	Room or elevated temperature	2-10 volts.
2.	Sodium cyanide	4 oz.
	Sodium carbonate	4 oz.
	Water	1 gal.
3.	Sodium cyanide	1-2 oz.
	Sodium formate	6-7 oz.
	Water	1 gal.

Precious Metal Alloy

U. S. Pat. 2,299,114. C. S. Sivil and E. O. Liebig, assignors to Baker & Co., Inc., Oct. 20, 1942. An alloy of 40-60% platinum, 20-40% palladium, 10-30% gold and 2-9% silver.

Phosphate Coating

U. S. Pat. 2,301,209. R. C. Gibson, assignor to Parker Rust-Proof Co., Nov. 10, 1942. The method of producing a phosphate coating upon a surface composed principally of metal of the group consisting of iron and zinc which comprises subjecting the surface to the action of a solution of an acid phosphate of a coating metal capable of resisting the oxidizing action of quinone and accelerating the coating action of the solution by including in the solution a compatible soluble quinone.

Obituaries

Harrison E. Howe

Harrison Estell Howe, Editor of *Industrial and Engineering Chemistry* for the past 21 years, died on December 10th in Washington, D. C. He was 62 years old. The Analytical Edition of *Industrial and Engineering Chemistry* and *Chemical and Engineering News* were inaugurated and developed by Dr. Howe and he also edited both these papers up until the time of his death.

Dr. Howe was born in Georgetown, Kentucky on December 15th, 1881. He was graduated from Earlham College, Richmond, Indiana, with a Bachelor of Science degree in 1901. He received his Master of Science degree from the University of Rochester in 1913.

Honorary degrees conferred upon Dr. Howe in the course of his life include a Doctor of Science from the University of Rochester in 1927; a Doctor of Laws from Southern College in 1934 and Doctor of Engineering degrees from Rose Polytechnic Institute in 1936 and the South Dakota School of Mines in 1939. In 1942, Dr. Howe was awarded the Chemical Industry Medal by the American Section of the Society of Chemical Industry. He was a fellow of the American Association for the Advancement of Science.

Dr. Howe's industrial career began as chemist for the Sanilac Sugar Refining Company. He left this company to join the staff of the Bausch & Lomb Optical Company where he remained until he became associated with Arthur D. Little, Inc., and its Canadian affiliate as assistant to the president and manager of Industrial Department, respectively. In 1919 he became Chairman of the Division of Research Extension of the National Research Council which position he left to become Editor of *Industrial and Engineering Chemistry* in 1921.

Dr. Howe was a member of the American Chemical Society, the American Institute of Chemical Engineers, the Cosmos Club, the Rotary Club, the Torch Club, Alpha Chi Sigma and The Chemists' Club (New York).

Frederick M. Becket

Frederick M. Becket, a consultant to the Union Carbide and Carbon Corporation, died on December 1st in New York City. He was 67 years old.

Dr. Becket was born in Montreal, Canada. He was graduated from McGill University with a Bachelor of Science degree in 1895 and received his Master of Arts degree from Columbia University in 1899.

In 1929 Columbia University bestowed upon Dr. Becket an honorary degree of Doctor of Sciences and in 1934 McGill University conferred upon him an honorary Doctor of Laws degree. In 1924 he received the Perkin Medal and in 1937 The Electrochemical Society's Acheson Medal Award. He was presented the Elliott Cresson Medal in 1940 by the Franklin Institute and in the same year received one of the Modern Pioneer Awards from the National Association of Manufacturers.

Dr. Becket was president of The Electrochemical Society in 1926 and was elected an honorary member in 1934. He was a fellow of the American Association for the Advancement of Science, and a member of the American Institute of Mining and Metallurgical Engineers, the American Chemical Society, the Mining and Metallurgical Society of America, the American Society for Metals, the Iron and Steel Institute of London, the American Institute of Chemical Engineers and the New York Academy of Sciences.

Bennet B. Bristol

Bennet B. Bristol, Treasurer and Clerk of The Foxboro Company, died at his summer home at Falmouth Heights, Massachusetts, on November 10th. He was 74 years old.

Mr. Bristol was born in Naugatuck, Connecticut. In 1893 he was graduated from the Stevens Institute of Technology with a M.E. degree.

Together with his brother, Edgar H., Mr. Bristol founded The Industrial Instrument Company in 1908. The company later became The Foxboro Company.

Necrology of 1942

During 1942 the following people who had been associated with the finishing field passed away:

+

Frank W. Burman

July 14. Prior to receiving a senior lieutenant's commission in the navy, Mr. Burman had been connected with The Egyptian Lacquer Manufacturing Company for 15 years.

+

Glenn Cannon

April 15th. Mr. Cannon was Secretary, Treasurer and General Manager of Advance Polishing Wheels, Inc.

+

Dr. Albert J. Dornblatt

February 2nd. Dr. Dornblatt was Research Chemical Engineer in charge of Metallurgy Division, Crown Cork & Seal Co.

+

Lloyd B. Edgerton

March 15th. Mr. Edgerton was Vice President of the Philadelphia Quartz Company.

+

Nathan P. Hunter

May 6th. Mr. Hunter was a salesman with The Egyptian Lacquer Manufacturing Company for 36 years.

+

William J. R. Kennedy

August 7th. Mr. Kennedy was Executive Secretary of the American Electroplaters' Society for the six years prior to his death.

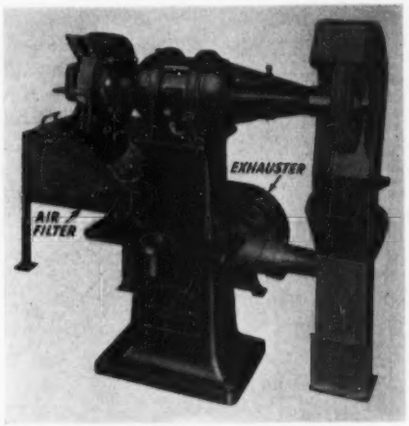
+

Charles H. Proctor

December 3rd. Mr. Proctor was the founder and a former president of the American Electroplaters' Society. He had retired from the Du Pont company nine years before his death.

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY



Combination Grinder and Buffer

Combination Grinding and Buffing Machine

A new design combination grinding and buffing machine is now being manufactured by the Standard Electric Tool Co., Dept. W, 2488 River Road, Cincinnati, O.

This equipment is illustrated below together with an exhauster arrangement for removing and collecting grinding and buffing particles which might otherwise disturb the operator and damage surrounding equipment.

The machine shown here is of the 2 HP type; other sizes available are 1 HP, 3 HP and 5 HP.

The left side has a safety hinge door emery wheel guard adjustable to wheel wear and fitted with adjustable spark breaker and work rest. The spindle is mounted in three heavy-duty ball bearings and the buffer end is fully enclosed. A tool tray and a removable water pot are fitted to the front of the pedestal.

The dust arrester assembly includes material handling fan, blower, air filtering stand and adjustable exhaust hood for the buffing wheel. The machine, motor and fan motor operate simultaneously through the push button starting equipment.

The dust collecting system is available separately for application to any type of grinding, buffing and polishing equipment and is manufactured in three sizes.

Abrasive Belt Backstand Idler

A new abrasive belt backstand idler for use in conjunction with abrasive belts has just been announced by Hammond Machinery Builders, Inc., 1601 Douglas Ave., Kalamazoo, Mich.

The machine illustrated shows the unit with a new spring-loaded adjusting screw and hand wheel (Patent applied for) which maintains uniform tension on the belts and releases tension to make belt changes. It is said this improved method utilizes surface-coated abrasive belts running over contact wheels employed on the grinder or polisher in conjunction with the new "Hammond No. 3 Backstand Idler," converting existing grinding, polishing and buffing equipment into high production, cost-cutting machines.

Hammond Model No. 3 is a heavy-duty type with ball bearing idler pulleys and simple adjustment for belt positioning and tracking. The machine can be used either right or left hand position by simply turning the idler wheel head and column 180 degrees and locking in position.

The uniform belt tension is obtained by a spring-loaded adjusting screw and hand wheel which, it is claimed, greatly increase the ease with which belt changes can be made and add greater convenience in the take-up of belt slack during operation.

The "No. 3 Backstand Idler" as employed with the Hammond "OD Cylindrical Finishing Machine" can be used on such parts as bombs, universal joints, condenser tubing, shell cases, gun barrels, steel tubing, brass magazines, etc., covering a range in size from ¼" to 9" outside diameter, straight or shouldered work. The "OD Cylindrical Finishing Machine" can also handle special types of work by the use of fixtures adaptable to the machine.

Drum Plug Wrench

Drum Plug Wrench

Industrial Products Co., 2820 N. Fourth St., Philadelphia, Pa., are the manufacturers of a new drum plug wrench designed to remove and tighten plugs or bungs in steel drums. It is manufactured in steel alloy with a long iron pipe handle and in "S monel" metal and fits all sizes.

Bulletin Display Cabinet

A new bulletin display cabinet, known as the M.S.A. Tell-Board, has been announced by Mine Safety Appliances Co., Pittsburgh, Pa. The unit is designed for better display of wartime safety and morale posters, instructions and special messages. Sturdily constructed of non-critical materials, the Tell-Board's glass-front cabinet permits quick change of bulletin materials through a novel design.

The M.S.A. Tell-Board is illuminated and equipped with simple hardware. Change of bulletin material is easy with a pivot joint at the top permitting the cover to swing up and away from the back where it is retained in an open position by a hold-out latch so that the fibre posting board can be removed or replaced.

Tightly fitting seams make the Tell-Board's use in exposed locations practical. Attractively finished in two-tone green enamel, the unit measures 32" x 25" x 3½", and is equipped with a glass sign with sandblasted letters reading "Safety Bulletins" or "General Bulletins."

Professional Directory

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Electroplating and Chemical Engineers
Complete services, including solution analyses, process development and deposit tests.
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JOSEPH B. KUSHNER, Ch.E.
Metal Finishing Consultant
War plating plants designed and streamlined for increased production.
LA 4-9794 **233 W. 26th St.**
New York City

Exhauster

Chelsea Fan & Blower Co., Inc., 1206 Grove St., Irvington, N. J., have developed a small, portable unit said to eliminate gases, fumes, etc., from closed-in places.

This exhauster-blower is powered by a ¾ H.P. ball-bearing motor, has heavy steel wheels, sucks or blows 2,000 C.F.M. and may be operated in any position. It features adapters for three 4″ nozzles or four 3″ nozzles for flexible hose and has caps to close the nozzles when not in use. According to the company, the 4″ metal hose of 20 ft. lengths will exhaust 250 C.F.M. each and the 3″ hose over 200 C.F.M. each.

Pump Tank to Control Magnesium-Type Incendiaries

In conformance with the emergency requirements of the United States government, the American-LaFrance-Foamite Corporation, Elmira, N. Y., have designed a new pump tank with the amount of critical materials in its manufacture reduced to a minimum.

This pump tank produces a straight stream and not a spray, which is in compliance with the latest requirement of the Office of Civilian Defense for controlling magnesium type incendiaries. Made in 5 gal. and 2½ gal. sizes, it has a large air chamber assuring minimum pulsation, a steady pressure and a more constant stream. It has a range of 30 to 40 feet. It is a self-contained unit and can be readily transported up ladders, over roofs and to points difficult of access.

It is equipped with a standard 26″ hose and its interior has a corrosion-resisting coating. The outside finish is of red enamel also designed to repel corrosion and to make its identity immediate.

Pump Tank.

Hair Protection for Women Workers

"Sta-Safe Hairgards" are a new development of the Standard Safety Equipment Co., 232 W. Ontario St., Chicago, Ill.

Designed to afford complete hair protection for women war workers, these combine smart appearance with all-over practicality. They are roomy enough to contain all the hair, have a non-flammable acetate visor to serve as a warning bumper if the wearer sneezes or leans too far forward and have a semi-rigid top to help warn of inadequate head clearance. The visor is transparent to allow upward vision and is made of pre-shrunk material which can be laundered frequently and be fireproofed.

These hair guards come in a light-colored fabric and are designed in five different styles one of which is illustrated.

New Hair Guard.

Improved Photoelectric Controls

To meet today's need for dependable automatic control of varied industrial operations, Photoswitch, Inc., 19 Chestnut St., Cambridge, Mass., has placed on the market an improved series of photoelectric controls, Type A15.

These controls include relay contacts designed to handle heavier loads directly, and conservatively rated at 10 amperes A. C. at 115 volts. The output terminals are those of a single-pole double-throw switch for either normally closed or normally open operation which provides for action either when the light beam is broken or when it is made.

The operating range of Type A15 is 20 feet with light source L30, and 40 feet with light source L60. Type A25 is supplied with light source L30 for 50 foot operation, and with light source L60 for 100 foot operation.

Type A15 series is said to provide rugged and efficient operation for such standard industrial applications as counting, conveyor control, machinery safeguards, signal and alarm systems, motor or valve control, inspection and break detection, as well as for many specialized processes.

Flame-Proof Blanket

C. Walker Jones Co., East Germantown, Philadelphia, Pa., have developed the "Jomac Fire Blanket"—a specially knit, flexible blanket claimed to be 100% flame-proof, regardless of the intensity of the fire.

These blankets are available in attractive, flame-proof containers that may be hung on the wall beside fire-extinguishers, in first-aid stations and in the equipment provided for air-raid wardens, thus making available effective, on-the-spot protection wherever there is the danger of a workman's clothes being ignited.

Liquid Dustproofer

"Evercrete", a new transparent liquid, is claimed to not only permanently dustproof but also to make concrete waterproof and crumbleproof, thus increasing its resistance to traffic and preventing the formation of ruts and holes.

This compound is applied by sloshing it around the floor until the concrete will not absorb any more.

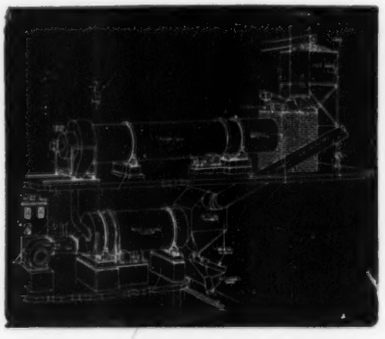
The material is said to be impervious to acids and absolutely odorless and to be a good binder for surfaces that are to be painted. It is a product of the Evercrete Corporation, 19 West 44th Street, New York City.

New Process of Reclaiming Foundry Core Sand

Announcement is made by Link-Belt Co., 300 West Pershing Road, Chicago, of the development of a new method of reclaiming foundry core sand.

Essentially, the equipment employed in this new method consists of a rotary kiln and Roto-Louvre cooler, as shown below. Binders, oils and other foreign materials are burned out of the shakeout-sand after the cores have been broken and screened. The sand is then cooled in a Link-Belt Roto-Louvre cooler.

A number of installations are now in service in war equipment foundries, reclaiming used core sand at a fraction of the cost of new sand, with considerable savings in labor, railroad transportation and handling. The sand reclaimed by this method is said to be as clean and usable as when new.



Installation for Reclaiming Foundry Core Sand.

Manufacturers' Literature

New Method for Faster Grinding, Finishing or Polishing

Newly developed equipment incorporating the use of surface coated abrasive belts for producing faster and better finishes, is described in a booklet recently released by *Minnesota Mining and Manufacturing Co.* of St. Paul, Minn.

The method consists of the use of a backstand idler unit, utilizing a newly perfected segment face contact wheel and surface coated abrasive belts. One's present lathe or set-up equipment can be used or a complete backstand idler unit acquired for this work.

There are three types of segment face contact wheels that increase the range of work with surface coated abrasive belts by providing a hard, flat surface for driving the belt but with a soft center so that irregular shaped pieces can be finished.

The segment face wheel using surface coated abrasive belts is also incorporated in a swing grinder for sanding billets, bars and tubes. Pedestal mounted or suspended from overhead rail, it is effective for repair grinding, beveling and surface grinding.

Tapes and Abrasives

Minnesota Mining and Manufacturing Co., St. Paul, Minn., have published a 24-page fully illustrated reference booklet showing the use of "3-M" products as related to the war program.

Their lines of abrasives and scotch tapes (adhesive, electrical and cellulose) are covered as well as their building maintenance products such as floor sanding materials, waxes and cements.

Etchers and Markers

Ideal Commutator Dresser Co., 1285 Park Ave., Sycamore, Ill., have issued a folded mailing leaflet describing their new electric markers and etchers.

The leaflet is printed in two colors and is illustrated giving full specifications of various items offered by this company.

Special emphasis is laid on the electric marker which is said to be used as easily as a pencil for marking metals, wood, plastics, porcelains, glass, hard rubber, etc., and on their new Model No. 13 electric etcher which is a compact unit for marking pieces made of steel, iron or their alloys.

Creams and Lotions

Complete details on M. S. A. "Fend" products for protection of workers' skin against industrial dermatitis, are to be had in a descriptive 16-page brochure just issued. Copies may be secured by writing directly to *Mine Safety Appliances Co.*, Braddock, Thomas and Meade Streets, Pittsburgh, Pa. Ask for Bulletin FA-79.

Faster, Better, at Lower Cost!

Bite into America's huge war production job almost any place where thousands of feeder factories have taken hold of their parts of the job and you'll find that our strength in the air, on the land, on and in the sea is growing in leaps and bounds because someone found a shortcut to Berlin with better materials and methods.

Among the Task Forces being concentrated to reach our objective of producing ENOUGH . . . IN TIME are McAleer metal finishing materials and methods. Engineered to meet the production finishing requirements of *today*, these Quality-Controlled buffing and polishing compositions are helping set new metal finishing standards in representative plants from coast to coast.

To cope with the demand for speed and more speed—you need, more than ever before, the specialized services McAleer offers. Less waste through elimination of rejects, greater output and low operating costs are the orders of the day in all war-time production finishing.

The battle begins here—let's fight and work together!

McAleer MANUFACTURING CO.
Quality-Controlled Finishing Materials
ROCHESTER, MICHIGAN

Steam Hose Maintenance

Containing simple, easy-to-read rules for the care and maintenance of steam hose, so vital now that rubber is so scarce, as well as detailed instructions on the proper methods to attach couplings, a revised catalog section on its lines of steam hose has just been issued by *The B. F. Goodrich Company* and is now available upon request to its principal offices in Akron, Ohio. Data on inside and outside diameters, weight and number of plies also are listed.

Concrete Preserver

"Facts and Uses of 'Evercrete'" is the name of a booklet published by the *Evercrete Corp.*, 19 West 44th Street, N. Y. C.

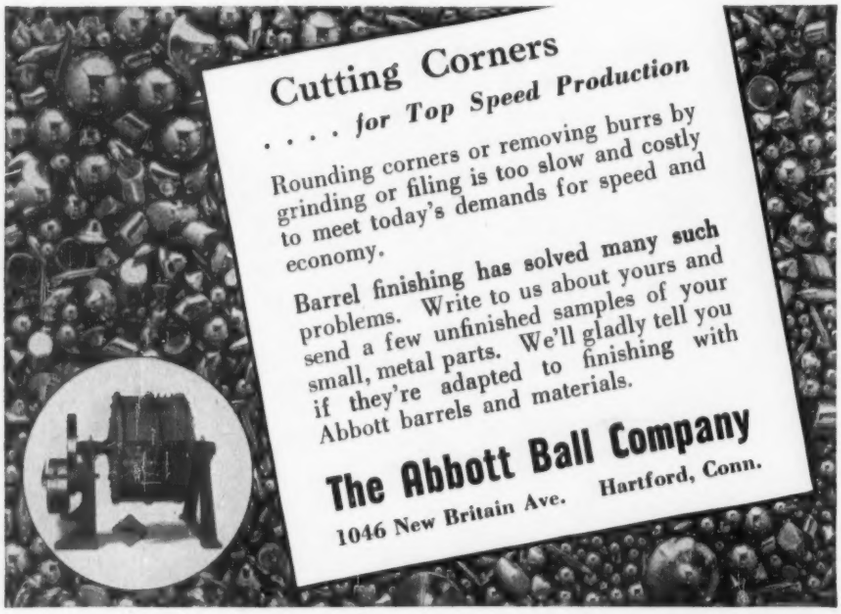
Corrosion-Resistant Equipment

United States Stoneware Co., 60 East 42nd St., New York City, have published a laboratory bulletin numbered 498.

A 12-page illustrated booklet, this discusses sink stands and outlets; table troughs and tops; acid-proof pipes, pipe fittings, traps, paints, floors and floor drains; diluting sump tanks, cement-asbestos pipe and ventilating equipment.

Metal Cleaning Check Chart

Quick help on the correct solving of your metal product cleaning problems is offered through a simple check chart analysis sheet, now being distributed by *The Hunnewell Soap Co.*, 116 W. Second St., Cincinnati, O.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. . . . for Top Speed Production
Rounding corners or removing burrs by grinding or filing is too slow and costly to meet today's demands for speed and economy.
Barrel finishing has solved many such problems. Write to us about yours and send a few unfinished samples of your small, metal parts. We'll gladly tell you if they're adapted to finishing with Abbott barrels and materials.
The Abbott Ball Company
1046 New Britain Ave. Hartford, Conn.

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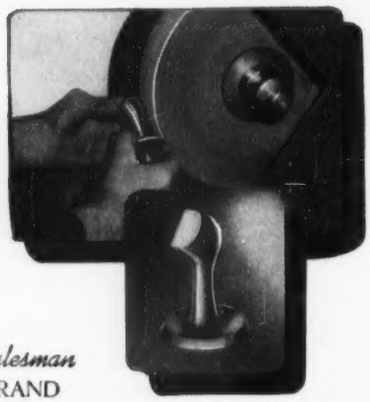

What a difference in your finished product when you use *Paramount Felt Polishing Wheels* for grease polishing—that all-important finish that swings the buyer's decision to your product.

Ask your supplies salesman for PARAMOUNT BRAND

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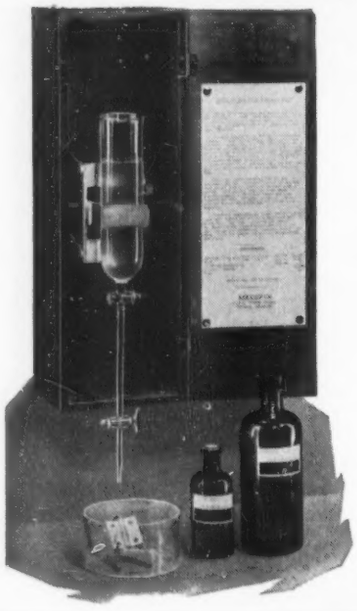
WINCHESTER MASS. ESTABLISHED SINCE 1824



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SOLUTIONS & DEPOSITS

Controlled with simple direct reading test sets.

Sets for other solutions and deposits also available

Write for Leaflets

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CHICAGO

Courses In Electroplating

The Institute of Electrochemistry & Metallurgy, 59-61 East 4th Street, New York City, will offer specialized courses in the field of electroplating, anodizing, and metallurgy during the spring term of 1943. Registration will be held for the spring courses from February 2 to February 5 inclusive and the first meeting will be held on February 9. The following courses will be offered:

Spring Courses

ELECTROPLATING II.

This course is designed to give the electroplater a knowledge of the ways and means of obtaining better deposits by applying the latest scientific methods of electrochemistry to electroplating. One hour of each evening will be devoted to a lecture on the theoretical aspects of the subject and two and one half hours will be spent in the laboratory where the student will apply the principles set forth in the lecture. Copper, nickel, zinc, cadmium, chromium, silver, and brass will be deposited from aqueous solutions. While plating the above metals, the factors governing the character of the deposit such as current density, temperature, pH, etc. will be noted. Other experiments will include throwing power, single electrode potential, addition agents, resistance of solutions, anodizing and coloring aluminum, corrosion tests, etc. After these are complete the student will prepare standard solutions and make analyses of all the important constituents of the above plating baths. Tuesday and Wednesday, 7:30-11:00 P. M. Prerequisite: Electroplating I. or its equivalent. Dr. Young and Mr. Klinsevich.

METALLURGY II. (Metallography):

This course is designed to teach the student preparation of metallographic samples for microscopic examination. Various samples of different metals and alloys will be polished, etched, and examined under the microscope. The detection of faulty alloys and metals will be stressed. Dr. Young and Mr. Klinsevich. Tuesday and Wednesday, 7:30-11:00 P. M. Fee: $25.00.

RESEARCH II:

This course is designed to give the practical electrochemist a chance to investigate problems in his field. One half hour per week is devoted to a conference with the instructor in which the method of attack is laid out. The remaining time is spent in the laboratory where the student applies his knowledge and technique to the solving of problems which arise in such an investigation. Tuesday and Wednesday, 7:00-11:00 P. M. Dr. Young. Fee: $30.00.

INDUSTRIAL MICROSCOPY IIA:

This course is specially planned in photomicrographical analysis, general microscopy, and instruction on the metallographic microscope. Subjects covered include the preparation of materials and the proper selection of optical equipment, methods of illumination, control of glare, illumination by incident light, and the use of color filters, special methods of particle-size determination, determination of refractive index, micrometry, and the proper use of mounting media with respect to its relative refractive index. Work with the polarizing microscope may also be arranged. Mr. Shillaber. Tuition and laboratory fees: $55.00. Hours to be arranged and announced later.

Time payments may be arranged if desired. For further information call Dr. C. B. F. Young, ORchard 4-1778 or FLushing 9-1685.

Correspondence Course in Electroplating

Several years ago a complete course in electroplating was written for the man in the industry. It consisted of twelve lectures in chemistry as applied to electroplating and twelve lectures in electroplating. The first twelve lectures contained a fundamental study of the elements and their compounds as applied to the deposition of metals. The second set of twelve lectures gave the fundamentals of electroplating and then discussed the deposition of a great number of metals and alloys. The anodizing and coloring of aluminum was taken up in detail. Methods of analyzing the baths were also given. The study came with complete laboratory facilities.

Due to the emergency this study has been discontinued. However, the twenty-four lectures and laboratory notes are being sold out at a very inexpensive figure. There are only a few copies of the first course and one hundred copies of the second course left. Those interested in more information and the cost, please write to Dr. C. B. F. Young, Box 292, Flushing, N. Y.

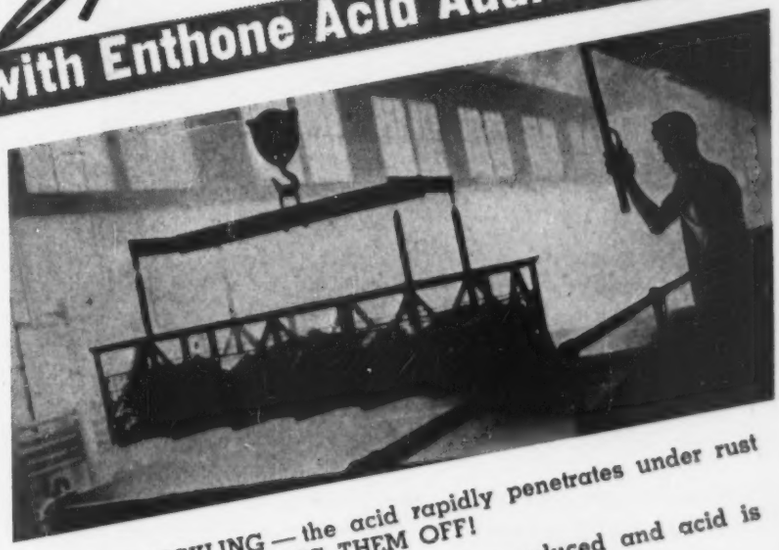
Publications on Electrodeposition

A list of publications of the National Bureau of Standards on electrodeposition revised to September 1st, 1942 can be obtained by writing the Superintendent of Documents, Washington, D. C. for Letter Circular LC 699. This supersedes LC 629.

American Standards Association Appointment

Ingle R. Shue of the *Gardner Machine Company*, Beloit, Wis., has been appointed a member of the American Standards Association's Sectional Committee on the Safety Code for the Use, Care and Protection of Abrasive Wheels.

Speed ACID PICKLING the DOUBLY SURE* Way with Enthone Acid Addition Agent



★ FASTER PICKLING — the acid rapidly penetrates under rust and scale, thus LIFTING THEM OFF!

★ SAVES ACID — Drag-out is materially reduced and acid is saved by inhibiting action.

OVERCOMES WATER-BREAK IN PICKLING — Due to poor alkaline cleaning or soap in the alkaline cleaner, water-breaks appear on acid dipping before plating. The use of ENTHONE AAA in the acid literally makes the acid a cleaner and overcomes peeling due to faulty cleaning.

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THE Enthone COMPANY
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McKeon's
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TRADE MARK REG'D
STRIPS COPPER PLATING
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SELECTIVE CARBURIZING
SULPHUR PRODUCTS CO. Greensburg, Pa.
(Service? Sure.)

HOW TO CLEAN WHAT··· AND WHY!

The First COMPLETE Technical Manual on Metal Cleaning

This new Magnus Handbook, now printing, covers the whole story on war time metal cleaning . . . The selection of the most suitable and satisfactory cleaning material, method and machine for each individual metal cleaning problem.

Nowhere else can you find under one cover the comprehensive and practical information at your command in this manual.

You'll need copies for every man in your plant who is concerned in any way with metal finishing operations.

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Manufacturers of Industrial Cleaning Materials—Washing, Drying, Pickling Equipment—Metal Drawing Lubricants. Also Methods Engineering Service.

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MAGNUS CLEANERS

Associations and Societies

Los Angeles Branch

Los Angeles Branch, A.E.S., held an "Aircraft Production Meeting" on the night of December 9 at Hotel Rosslyn, which featured a talk on "Methods of Racking Aluminum Parts for Anodizing" by *W. Paul Sykes*, Foreman of the processing department, Vega Aircraft Co., Burbank, Calif.

Among the 60 persons in attendance, approximately half were employees of the metal finishing and processing departments of Vega, Lockheed, Douglas, Vultee and Northrop Aircraft Companies.

Mr. Sykes discussed various experiments in designing racks and hangers for aluminum alloy heat-treating and anodizing and methods for racking airplane parts for anodizing, hanging parts for anodizing and loading for chromidizing.

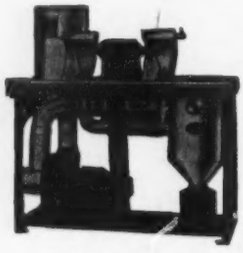
He declared the most serious error a shopman can make is not to give proper thought to the best method for hanging parts. The shape of an article to be processed, Mr. Sykes stated, makes imperative careful consideration of how it should be hung before it is placed in the tank.

In connection with hanging parts for anodizing, Mr. Sykes enumerated various types of hanging devices which are available, including coil springs, spring clips, hinged-rod sheet holders, mesh baskets for castings and special multiple rack sheet holders. He displayed diagrams of some of the hangers which he discussed and drawings of experiments which had been made at the Vega Co.

Ernest Lamoreux reported that with the taking over of the Rosslyn Hotel by the Army, arrangements had been concluded for holding future branch meetings (beginning with the January session) in the Los Angeles Elks Club.

Marcus Rynkofs, chairman of the Educational Session Committee, reported that a 1943 educational session would definitely be held in March, with the Elks Club as the scene.

Blower


Polishing Bench

Dryer

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THE BOLAND SYSTEMS **FOR FACTORY INSTALLATIONS** Tanks, Coloring Rooms, Dynamos, Sawdust Boxes

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News From California

By Fred Herr

Cannon Electrical Development Co., Los Angeles, has increased the size of its plating and polishing room from 50 x 100 feet to 50 x 200 feet to handle additional work on defense contracts.

Carroll McClaren, Plating Room Superintendent, reported that much work is now being done by the Cannon Co. on cable connections for U. S. Signal Corps equipment. Earlier in the year the Signal Corps demanded nickel finish but has now expressed readiness to accept zinc finish.

In an effort to reduce cadmium consumption, a wider use of zinc is now being made, particularly on steel items, McClaren declared, in consequence of which the Cannon Co. has added a new 150 gallon zinc tank to its facilities.

Don Bedwell, operator of an independent electroplating and metal processing shop at 1344 West Slauson Ave., Los Angeles, has augmented his equipment by installing a Pentrate bluing system for steel, supplied by the Heatbath Corp. The Bedwell shop is working on reflectors for airplanes, bomb fuses and other ordnance items. *Walt Plummer* is Night Superintendent.

Joseph Sunderhaus, Plating and Polishing Room Foreman for the *F. E. Olds Band Instrument Co.* of Los Angeles, reported that the firm on December 9 was presented with an "E" banner for meritorious work performed on war products, chiefly handle-shafts and hydraulic gear for airplanes which the firm makes for the Clarke Aero-Hydraulic Co. of Pasadena.

The Rosslyn Hotel, Los Angeles, meeting place of Los Angeles A.E.S. for a number of years, was taken over by the Army for housing military personnel, effective December 15. The branch has made arrangements to hold its future meetings on the second Monday of each month at the Los Angeles Elks Temple, West Sixth St. and Parkview Ave., beginning with the January 11 session.

E. E. Parker has established the *Southern Galvanizing Co.* at 133 Palmer St., Compton, Calif.

Shelman Baked Enamel Co. opened for operation December 1 at 252 South San Pedro St., Los Angeles. *Orville S.* and *L. E. McKenzie* are the heads of the firm.

John Merigold, who opened a new gold and silver plating shop several months ago, reports he found it necessary in December to add an extra room to his working area in a downtown office building at 424 South Broadway, Los Angeles. In addition to his original gold and silver equipment, Mr. Merigold has just installed zinc plating facilities for work on contact points, microphones and other communication instrument parts.

CHROMIC Acid

99.75% PURE

With two complete, independent plants at Jersey City and Baltimore, and its own supply of the basic raw material Chrome Ore from company owned and operated mines, Mutual is the world's foremost manufacturer of Chromic Acid.

BICHROMATE OF SODA
BICHROMATE OF POTASH

Mutual Chemical Co. of America
270 MADISON AVENUE, NEW YORK

MUTUAL CHEMICAL CO. OF AMERICA — MUTUAL — NEW YORK, N.Y.

SUPERB PERFORMANCE!
FOR UNPARALLED SPEED AND UNIFORMITY . .

4A CEMENT and THINNER A Substitute for Glue. NO WORRY ABOUT GLUE SHORTAGE WITH 4A CEMENT AND THINNER. Polishing wheels are free cutting, long lasting and economical when set up with 4A Cement.

COLORING ROUGES UNIFORM, CAREFULLY GRADED RAW MATERIALS, EXPERTLY COMPOUNDED BY HARRISON'S TECHNICIANS, INSURE ROUGES THAT GIVE HIGH LUSTER AND FAULTLESS FINISHES.

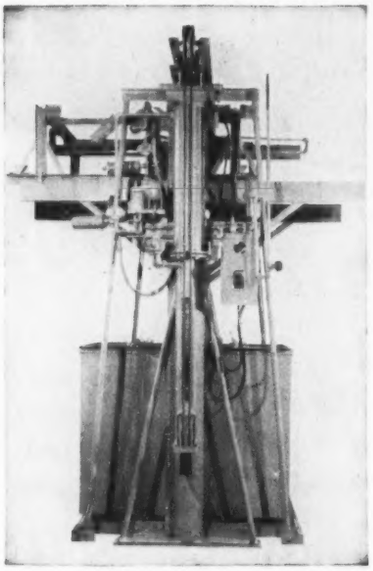
POLISHING COMPOUNDS 4A symbolizes these four features which you require for high speed polishing, mirror finishing of all kinds of steel, including stainless steel, carbon steels and hard-to-buff alloys. Use it on any kind of a wheel, soft, medium or hard.

Tell us your problem and samples of compounds, rouges or cement will be sent. We will be pleased to recommend proper methods.

"AMPLE STOCKS TO TAKE CARE OF OUR TRADE"

4A HARRISON and COMPANY
Haverhill, Mass.

Crown Pick-up Unit



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A UNIT TYPE TRANSFER CAPABLE OF HANDLING SEVERAL TANKS AT ONE TIME.

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FOR A SERIES OF OPERATIONS WHERE THE WORK MUST PASS THROUGH SEVERAL TANKS, AS THE CLEANING AND RINSING OPERATIONS, FOR A SEMI-AUTOMATIC PLATING TANK.

CROWN RHEOSTAT & SUPPLY CO.
1910 MAYPOLE AVENUE :-: :-: CHICAGO, ILLINOIS

The BLACK-MAGIC Witch is riding her broom into many a plant bogged down with "rulings" on "contracts."

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"The one bath process"

If you have a blacking problem, if you are interested in a rust resistant, or a bond for paint or lacquer, or varnish—

If you want a Government approved black oxide for under or outer coat—

Contact a BLACK-MAGIC man, or write for portfolio of complete information.

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Lea Manufacturing Co.
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New firms which received permits for operating in Southern California during the closing month of 1942 are the following:

Oliver Machine Works, 3516 Helms Ave., Culver City; *Joseph G. Oliver* and *H. E. Pratt.*

H-L Tool Co., 350 West Slauson Ave., Los Angeles; *E. J. Burns* and *Roger H. Stokes.*

Hutton Machine Works, Inc., 106 Emerald St., Redondo Beach; *L. C. Hofford*, Redondo Beach; *J. A. Helget*, Los Angeles, and *L. R. Gray*, Manhattan Beach.

Frank Machine Works, 2611 Alice St., Los Angeles; *David Frank.*

Defense Plant Corp. has authorized contracts to *H. K. Ferguson Co.* of Cleveland, Ohio, for construction and equipping of a detinning plant in Southern California at a cost of $1,500,000, to be operated by the *Los Angeles Tin Corp.*

United States Chrome Mines, Inc. has ordered equipment to double the capacity of its concentrating plant at the Pilliken chrome mine in the Placerville, Calif., area. The enlarged plant will handle 500 tons of ore daily.

United States Chrome is treating 200 tons of chrome ore daily at its Grey Eagle property in Glenn County, and has arrangements under way for operation of two plants with a combined daily capacity of 400 tons of ore, on chromite deposits in San Luis Obispo County, Calif.

Metals Reserve Co. has established a stock pile for high-grade manganese ore at Parker, Ariz. The new depot, the M. R. C. announced, will purchase ores containing 35% or more manganese and will also take delivery on chromium and mercury.

Metals Reserve Co. will not buy low-grade manganese, however. It is reported that a new market for low-grade manganese is available at Fontana, Calif., where the Henry J. Kaiser Co. will use low-grade manganese for steel making in their new multi-million dollar steel plant which is expected to get into operation early in 1943.

Discovery of extensive manganese deposits in the Mason Valley area of San Diego County, Calif., was reported in December by *Charles H. Reed*, Secretary of the County Bureau of Mines.

The ore vein was reported to be four feet wide on the surface and to extend for two miles.

Reed also reported that consultations have been held relative to the location of a reputed deposit of iceland spar, a strategic war material used for polarizing light and in the manufacture of precision instruments.

Fire originating in the finishing department when sparks from an electric drill touched off a pile of magnesium shavings, caused a damage of several thousand dollars to the plant of *Magnesium Products, Inc.*, 1119 Santa Fe Ave., Los Angeles, on December 14. A series of explosions which rocketed heavy castings out of the plant and threw showers of burning magnesium into the streets resulted. One employee received minor burns.

W. E. Hurd Dies

W. E. Hurd, one of the charter members of Los Angeles Branch, A.E.S., died at his Willowville, Calif., home on November 29, at the age of 77.

At the time of his death, Mr. Hurd was completing his 12th year as plating room foreman for the *Pacific Gas Radiator Co.*, Huntington Park, Calif. He had previously served for a number of years in the processing division of the General Electric Co.'s Hotpoint plant at Ontario, Calif.

Mr. Hurd was originally from Chicago where he had been active in Chicago Branch of the A.E.S. He is survived by his widow and one daughter, Virginia Hurd.

The funeral was December 2 with a number of prominent Southern California members of the industry in attendance.

Business Items

The 1942-3 Annual General Conference on sales and service of the *Detroit Rex Products Co.*, 13009 Hillview Ave., Detroit, Mich., manufacturers of industrial metal cleaning equipment and chemical cleaning compounds, was held December 11 and 12 at the Fort Shelby Hotel, Detroit. One hundred and ten sales and service engineers, including men from all field and branch offices of the company, attended.

On the morning of December 11 the men visited the main and subsidiary plant buildings and offices in a personally conducted tour. Metal washing machinery and equipment, now produced exclusively for use in war production plants, was seen in various stages of construction.

At the noon dinner meeting, which officially opened the conference sessions, *President Robert A. Emmett* outlined briefly important phases of company past history and discussed research and planning for the post war period.

W. W. Davidson, Vice President in charge of sales, conducted the conference and introduced other members of company personnel, including *G. E. Powers*, Treasurer, *C. F. Dinley, Sr.*, Vice President in charge of Engineering, and *A. O. Thalacker*, Secretary and General Manager.

The material presented was of a technical nature, dealing for the most part with subjects such as: Design and Construction of Degreasers and Alkali Washers, Metal Cleaning in Aircraft Manufacturing Plants, Application and Operation of Metal Washers, and Cleaning and Finishing Problems. Photographic slides and color movies were employed by many of the speakers to emphasize their messages.

Walter E. Gibson, formerly Advertising Manager of the Swartzbaugh Mfg. Co., Toledo, Ohio, has joined the advertising staff of *Detroit Rex Products Co.*, Detroit, Mich.

Leads in Scrap Drive

Scrap totaling 1,023,327 pounds, or nearly one-sixth of the total amount collected by all of the plants in the busy Passaic, N. J., industrial area, was turned in by *The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.*, during the first six months of the WPB industrial scrap drive.

Collections at Manhattan were reported to include: cast iron and steel (including borings, trimmings and sheet metal)—923,238 pounds; brass—12,315 pounds; lead—2,000 pounds; copper—1,117 pounds; aluminum—2,403 pounds; burlap—7,255 pounds; rags—44,165 pounds, and paper—30,780 pounds.

The drive also focused attention on machinery and equipment that was being used infrequently because of changes in products and processes, and what could be spared was sold to other local shops having important war sub-contracts, in the execution of which this equipment could be used.

Several interesting items of scrap were uncovered in the Brighton Mill Annex, recently acquired by Manhattan. These included a 4,100 pound steel boom used by the old Fokker Aircraft Co. for lowering airplane wings from the third floor of one of the buildings and 2,000 pounds of lead plate used in a drying room. In these instances, as well as many others, the cost to remove the obsolete equipment was more than the salvage value, but no attention was paid to this cost in the effort to make every possible contribution to the nation's scrap pile.

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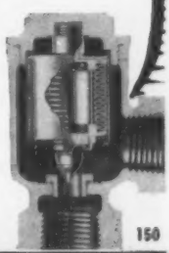

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Appointments at C. G. Conn, Ltd.

Frank K. Savage has been appointed General Superintendent of *C. G. Conn, Ltd.*, Elkhart, Ind. Mr. Savage started work with C. G. Conn, Ltd., on October 1st, 1935 as a chemist. In the course of his employment he filled positions as chief chemist, plating room foreman and research chemical engineer.

In 1935 he was graduated from Michigan State College with a B.S. In 1941 he received his Ch. E. degree.

Vincent Mattacotti, since 1934 with the Hanson-Van Winkle-Munning Co., Chicago, Ill., recently became Research Director of C. G. Conn, Ltd. of Elkhart, Indiana.

Mr. Mattacotti received his B.A. and M.A. from Wesleyan University, Middletown, Conn. He is librarian of the Chicago Branch, American Electroplaters' Society. He is also a member of the Electrochemical Society, and Electrodepositors' Technical Society.

Goodrich Men in Gov't Posts

Three more *B. F. Goodrich Company* technical men have been loaned to the United States government and assumed posts in organizations administering the nation's synthetic rubber program on Dec. 1st, it was announced by *T. G. Graham*, B. F. Goodrich vice president.

W. R. Hucks, manager of the raw materials division of the company, will be assigned to the operating division of the Rubber Reserve Company. He joined B. F. Goodrich in 1926 as a compounder in the tire division, went to the California plant in 1928 as chief chemist, later becoming technical manager of the Pacific division. He returned to Akron in 1938 to take over his present work. Hucks is a graduate of Georgia Tech.

R. G. Boyd, manager of planning and scheduling in the tire division, has been assigned to the allocation division of the War Production Board. He joined B. F. Goodrich in 1927 shortly after his graduation from the United States Naval Academy. After several years in the technical service division, he was assigned to foreign service by the company, returning to Akron from France in 1939.

R. J. Hull, who will serve on the staff of the Rubber Administrator, is assistant manager of compounding in the company's tire division. He came to B. F. Goodrich in 1927 after graduating from Purdue University. After experience in the company's general chemical laboratories he was transferred to the tire division as a compounder.

Mathieson Changes

The Mathieson Alkali Works, Inc., 60 East 42nd St., New York City, announces the retirement of *John A. Kienle*, Vice President-Director of Sales on November 18th, 1942. Mr. Kienle joined the Mathieson Alkali Works as Manager of Sales in 1920 and was elected to the position he held at the time of his retirement in 1922.

Esse E. Routh has been elected Vice President-Director of Sales. He was educated at Virginia Polytechnic Institute and Davidson College. Mr. Routh has spent his entire business career with the company. In his early years he was at the Saltville, Va. Works. He served as Southern Sales Manager from 1920 to 1928 and as General Manager of Sales from 1928 to date.

Robert J. Quinn becomes Assistant to the Vice President-Director of Sales. He received his chemical engineering degree from the University of Illinois in 1912. He joined the company in 1920 as Western District Sales Manager in Chicago, Ill., and became Assistant General Manager of Sales in the New York executive office in 1923.

D. W. Drummond has been appointed General Manager of Sales. He was born in Philadelphia and graduated from the University of Pennsylvania in 1926. Mr. Drummond joined the Mathieson organization in 1938, became Manager of Solid Carbon Dioxide Sales in 1939 and Assistant General Manager of Sales in 1941.

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Another of the large scale government-financed synthetic rubber plants has just begun production operations, it is reported by John L. Collyer, president of *B. F. Goodrich Company* of Akron, Ohio.

The new plant, located in Kentucky, is an important unit in the government's synthetic rubber program which on completion calls for the production of more than 875,000 tons of synthetic rubber annually.

The newest synthetic rubber plant will ultimately utilize butadiene made from alcohol and will shortly be in full scale production of general purpose synthetic rubber for use by the armed forces of the United Nations.

Frederick Gumm Chemical Co., Inc., are engaged in the construction of an addition to their building on 538-542 Forest Street, Kearny, N. J. The building is 50 x 100 feet and adjoins the present building they now have on Laurel Avenue to complete an "L" from their Forest Street plant. This new addition will account for 5000 square feet.

W. Mikelson of the *General Electric Company*, Schenectady, N. Y., and *A. M. Swigert*, master mechanic of the *Chrysler Corporation*, Detroit, have been appointed members of the Sectional Committee on Classification and Designation of Surface Qualities of the American Standards Association.

Adrian G. Allison, former ceramic engineer of the Electro Refractories & Alloys Corp. of Buffalo, N. Y., has been appointed to the research staff of *Battelle Memorial Institute*, Columbus, Ohio, and assigned to its Division of Ceramic Research.

Mr. Allison, who holds Bachelor of Ceramic Engineering and Master of Science degrees from Ohio State University, will be engaged in a program of research in the development of new manufacturing methods for the ceramic industry.

A specialist in refractories and plant engineering, he was ceramic engineer for the Chas. Taylor Sons Co., Cincinnati, subsequent to his position with the Electro Refractories and Alloys Corp. He is a member of Keramos and Tau Beta Pi.

Joseph B. Shelby has been appointed Assistant Sales Manager of the *Driver-Harris Company*, Harrison, N. J., manufacturers of special alloys. Prior to this appointment he was Manager of the foundry.

During the first world war, Mr. Shelby served as Captain in the 31st Artillery Brigade CAC. Prior to that, Mr. Shelby was connected with the General Electric Co. of Schenectady. In 1918 he became connected with the Driver-Harris Co. as Sales Engineer.

Mr. Shelby was graduated from the University of Kentucky in 1910.

Christmas checks totalling more than $235,000 were distributed to 3,000 plant and office workers of *Acme Steel Company*, Chicago, according to an announcement made by Charles S. Traer, President.

Similarly remembered were the more than 400 Acme employees now in the armed services in all parts of the world.

Present employees whose service with the company began on or before July 1, 1942 were given the equivalent of two weeks' salary or eighty hours' pay at basic hourly rates. Bonuses for those whose employment dated from July 2, 1942 were based on one week's salary or forty hours' pay at basic hourly rates. Checks for all Acme employees in the service were on the same basis.

Appointment of *Thomas J. Mulvey* as production manager of General Electric's River Works at Lynn, Mass., has been announced by G. M. Stevens, acting manager.

Mr. Mulvey was born in Schenectady, N. Y. In June, 1906, he entered the employ of the General Electric Co. at its Schenectady plant as a clerk in the production department.

Since March 1, 1935, Mr. Mulvey has been a member of the manufacturing general department at Schenectady on the staff of G-E Vice President W. R. Burrows. In January, 1937, Mr. Mulvey was transferred to the Erie, Pa., plant as production manager, holding that position until his new appointment.

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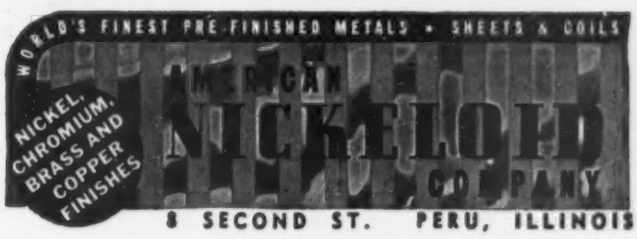

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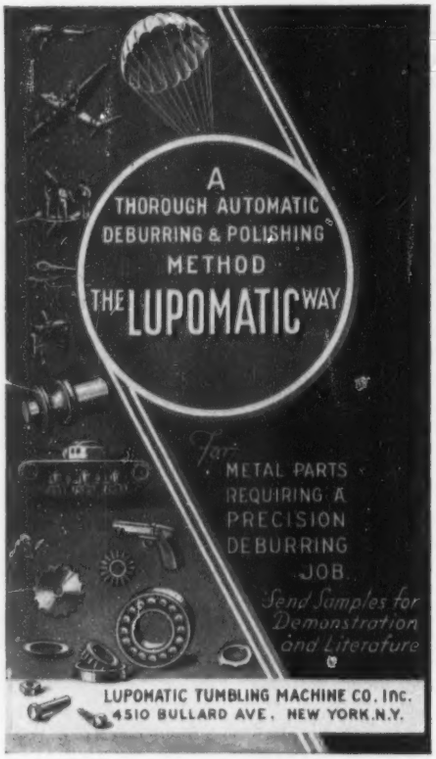

Personals

Al Baker, C.M.M.

Friends of Al Baker (M. E. Baker Co., Cambridge, Mass.) can address letters to him at the following address: Al Baker, C. M. M., Navy 8075, Fleet Post Office, San Francisco, California.

Lt. Palmer Langdon

Palmer Langdon, formerly assistant editor of METAL FINISHING, has since August been with the Engineer Amphibian Command, a part of the Corps of Engineers, as a navigation officer. This newest unit of the Army transports the combat infantry teams in various types of landing craft helping them to establish beachheads. At the present time, Lt. Langdon is stationed in Florida.

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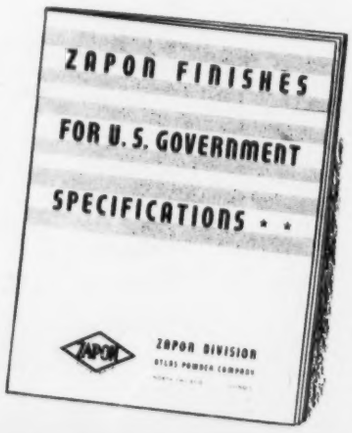

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JANUARY, 1943

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Synthetic Paint Brush Bristles

For a long time there has been a need in the United States for a source of bristles for paint brushes which would relieve us of dependency on imported pig bristle. Until recently it appeared that there was no way out. Now there is one. The manufacture of synthetic bristles suitable for use in paint brushes has been announced. A pilot plant is in operation and two full scale plants are expected to be completed this year.

These synthetic brush bristles are tough, resilient, and inert to finishing material ingredients and tests which have been made indicate that they will far outlast natural pig bristle. The process of making these bristles has been so perfected that even the taper of natural bristle, necessary to good brush construction, has been duplicated.

The perfection of the process comes at a good time. The bulk of imported bristle originates in China and Russia and because of the war, supplies have not been easily obtained. Brush manufacturers have attempted to develop pig bristle production in the United States but, unfortunately, bristle from our own pigs does not compare in length and quality with the imported varieties. Experiments with substitutes such as other animal hairs and vegetable fibers, have not worked out too well either.

Of course, brushes made with synthetic bristle probably will not be available to the public until after the war. The production of the present small plant and the two larger plants which are to be built is for military purposes. However, synthetic bristles for paint brushes are an actuality and we know that we will have better and, very probably, cheaper brushes than in the past.

L. H. LANGDON, *Publisher* • T. A. TRUMBOUR, *Business Manager*

THIS IS WASHINGTON—

By George W. Grupp
METAL FINISHING's Washington Correspondent

Acrylic Resins Under Control Acrylic resins, acrylic monomer, Nethacrol, Primal, Rhoplex, Lucite, Flexiglas, Acryloid and Crystalite which are used for aircraft glazing, protective coatings for military leathers, and in the production of instrument lenses, optical equipment and combat boats for the Navy, were placed under rigid allocation and control on January 1, 1943 by General Preference Order M-260, dated December 10, 1942. Inventories of first grade acrylic resin cast sheets or virgin acrylic resin moulding powder may not be used in quantities over 25 pounds except for the detailed uses defined in the order.

Alcohol Production Expansion Planned At meeting of the Industrial Alcohol Producers Advisory Industry Committee in Washington on November 19, 1942, Dr. Walter G. Whitman, assistant chief of the Chemical Division of the War Production Board, stated that new plants will be constructed to produce sufficient stocks of alcohol to meet industrial needs in 1943. These plants he said were necessary in spite of the fact that the conversion of beverage distilleries is a success. By February the Wheat Alcohol Research Committee is expected to reach definite conclusions on the usefulness of wheat as a source of alcohol.

Chemical Committee Meeting During the first week in December, at a meeting of the Chemical and Organic Pigment Industry Advisory Committee, representatives of the WPB Protective Coatings Section pointed out to the members of the Committee the necessity of determining the end-use of various pigments. A sub-committee was appointed to compile data on the essentiality of the various pigments. At the next meeting of the full Committee, tentatively set for January 28, 1943, a new order to regulate the manufacture and sale of organic pigments will be the principal theme of discussion.

Coating Orders Revoked Conservation Can Enamel Order M-108, Conservation Closure-Enamel Order M-116, and Conservation Drum Exterior Coating Order M-158 were revoked on December 17, 1942 by Ernest Kanzler, Director General for Operations of the WPB. These revoked orders restricted the use of materials such as nitrocellulose, ethyl cellulose, vinyl resins, alkyd resins, para-phenyl-phenol resins, phenolic resins, castor oil, oiticica oil and tung oil.

Ethyl Alcohol Order Amended For the purpose of saving an additional 1,000,000 gallons of ethyl alcohol per year for industrial and military purposes, General Preference Order M-30, as amended on December 3, 1942 limits the use of alcohol in toiletries and cosmetics, shoe polish, candy glazes and deoderant sprays to 50 per cent of the base period.

Lithopone Adjustable Pricing Adjustable pricing for the sale of lithopone, effective December 2, 1942, was established by OPA in the issuance on November 27, 1942 of Amendment No. 4 to Revised Price Schedule No. 80. Because a shifting of the cost situation with resulting changes in price structure and price regulation tended to make long term contracts risky transaction, under the terms of this amendment, the seller and the buyer are permitted to agree to fix prices on delivery which are no higher than the maximum prices in effect at that time.

Organic Plastic Committee Meeting At a recent meeting of the Organic Plastics and Resins Manufacturing Industry Advisory Committee, it was revealed that the shortage of phenol is the greatest problem in the production of phenolic resins and moulding compounds. Another thing which was brought to light is the condition that there is no available surplus of thermoplastic resins for items which are less essential than those in Class III under Order M-154. The committee recommended the use of extenders which produce a lower phenol content. They recommended further that mandatory limitations should be placed on extenders so that all producers and fabricators will be placed on an equitable basis.

Phthalic Alkyd Resins Controlled Since 95 per cent of all phthalic alkyd resins are used for protective coatings, an essential ingredient in superior coatings for military and naval uses, they have been placed under allocation control by General Preference Order M-139, dated December 7, 1942.

Shellac Advisory Committee Meets At a recent meeting of the WPB Shellac Industry Advisory Committee of the Chemical Division's Protective Coatings Section, the committee discussed the possibilities of revising Order M-106 for the purpose of bringing seedlac and bleached shellac under the order's terms because of their increasing shortage.

Titanium Pigments Order Revoked Restrictions on the use of titanium pigments were removed by the revocation of General Preference Order M-44. There is said to be about nine months' supply in the United States from foreign sources. Domestic ilmenite production, which is now about 40 per cent capacity, is expected to reach a total production of 26,000 tons a month within a short time. This should yield about 12,000 tons of titanium oxide per month.

Titanium Pigments Adjustable Pricing Adjustable pricing for the sale of titanium pigments, effective December 2, 1942, was established by OPA in the issuance on November 27, 1942 of Amendment No. 3 to Revised Price Schedule No. 98. The shifting of the cost situation with resulting changes in price structure and price regulation, tended to make long term contracts risky transactions; therefore, under the terms of this amendment the seller and the buyer are permitted to agree to fix prices on delivery which are no higher than the maximum prices in effect at that time.

Vinyl Resin Committee Meets At a meeting of the WPB Pyroxylin Vinyl Resin Coated Paper and Fabrics Industry Advisory Committee on November 30, 1942, the members of the committee were told by Wells Martin that there is a shortage of such critical materials as nitrocellulose, film scrap, ethyl cellulose, castor oil and vinyl resins. Because of this shortage he said that the production of these commodities for civilian uses must be curtailed. The members were urged to do research to find substitutes, and they were asked to help eliminate cross-haulage in shipping their goods.

STRENGTH OF NITROCELLULOSE SOLVENTS

Comparative Toluene Dilution Ratios of Pure Solvents and Solvent-Coupler Mixtures

ARTHUR K. DOOLITTLE

Carbide and Carbon Chemicals Corporation,
South Charleston, W. Va.

Several criteria have been proposed to evaluate solvent strength as related to the use of solvents in lacquers. This paper makes available some new data that provide a more comprehensive view of the subject.

The criteria studied here are (1) toluene dilution ratios, (2) viscosities of solutions of nitrocellulose in the solvents and mixtures, and (3) phase diagrams which provide a complete evaluation of solvent strength by combining both dilution ratio and viscosity data.

Dilution ratios and viscosities of nitrocellulose solutions are given for the pure solvents belonging to homologous series of acetic esters, ketones and ether-alcohols and for some thirty binary mixtures of pure solvents with various alcohols. Tables indicate the composition of maximum solvent strength in each of the binary mixtures studied.

Phase diagrams are given for nitrocellulose solutions in four lacquer solvents of commercial purity, and the preparation and interpretation of the diagrams are discussed.

THE value of a solvent for nitrocellulose depends upon a number of factors which vary in their importance according to the type of lacquer in which the solvent is to be used. Among the factors which must be considered in evaluating a solvent for a particular purpose are cost, odor, color, stability, evaporation rate, solvent strength, compatibility with gums and resins, blush characteristics, and flow characteristics. It is not the intention of this paper to place undue emphasis on the importance of the solvent strength of lacquer solvents, since this is but one of the factors contributing to the value of a solvent. The purpose is, rather, to make available to the industry new data that provide a more comprehensive view of the subject and to draw certain obvious conclusions from the data.

A number of methods of evaluating the solvent strength of solvents have been proposed by investigators in this field (*2, 4, 8, 20, 22, 27, 28*) but only two methods are commonly employed which are related to the actual performance of the solvents in lacquers. These two methods are known as the dilution ratio method and the viscosity method.

Baker (*2*) in 1913 first proposed that the viscosity of solutions of nitrocellulose in mixtures of solvents might serve as an index to the solvent strength of the mixtures, and much subsequent matter appears in the literature in regard to the viscosities of solutions of nitrocellulose in mixtures (*1, 3, 14–16, 19–23*). To Sproxton (*27*), however, belongs the credit

(Reprinted from "Industrial and Engineering Chemistry," February, 1938.)

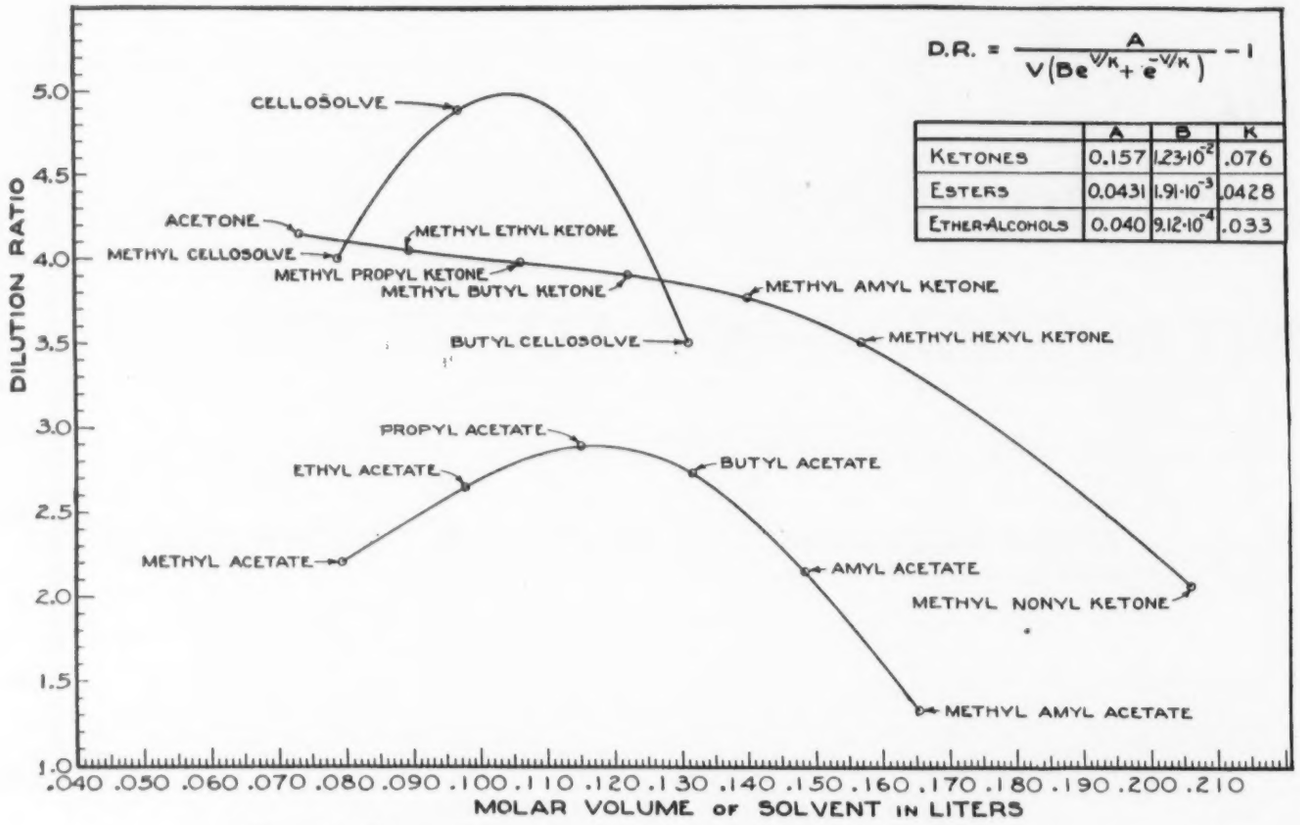


FIGURE 1. SOLVENT STRENGTH OF PURE KETONES, ESTERS, AND ETHER-ALCOHOLS

for first suggesting that the tolerance of the solvent for diluent, subsequently termed the "dilution ratio," might also serve as a means of evaluating solvent strength. This method has proved of great value, and considerable literature on the subject has appeared in the past ten years (*5–9, 11, 12, 13, 17, 24, 25, 29*). In a contemporary paper by the author and associates (*12*), the dilution ratio as an analytical method is described, together with a discussion of the sources of error. All determinations of dilution ratios reported herewith were made according to this procedure.

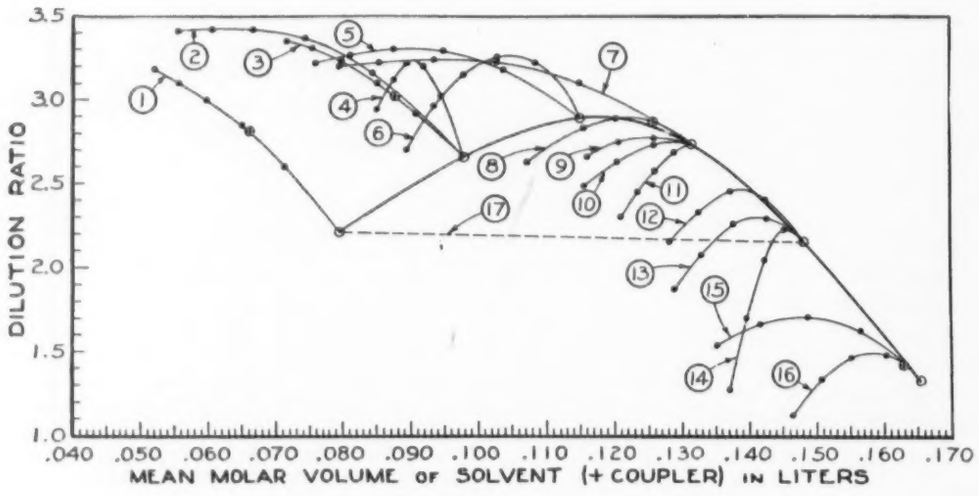


FIGURE 2. SOLVENT STRENGTH OF ESTERS

1. Methyl acetate–methanol
2. Ethyl acetate–methanol
3. Ethyl acetate–ethanol
4. Ethyl acetate–isopropanol
5. Propyl acetate–ethanol
6. Propyl acetate–propanol
7. Butyl acetate–ethanol
8. Butyl acetate–n-butanol
9. Butyl acetate–isobutanol
10. Butyl acetate–*sec*-butanol
11. Butyl acetate–*sec*-amyl alcohol
12. Amyl acetate–amyl alcohol
13. Amyl acetate–*sec*-amyl alcohol
14. Amyl acetate–2-ethylbutanol
15. Methyl amyl acetate–amyl alcohol
16. Methyl amyl acetate–methyl amyl alcohol
17. Methyl acetate–amyl acetate (mixture not defined by Equation 2)

The present paper compares the solvent strength of those solvents for nitrocellulose that belong to homologous series in the three principal classes of solvents (esters, ketones, and ether-alcohols), and it likewise provides a study of the solvent strength of mixtures of many pure solvents with various alcohols (couplers).

Three criteria are employed in this study to evaluate solvent strength—the toluene dilution ratios, the viscosities of solutions of nitrocellulose in the solvents and mixtures, and phase diagrams which provide a complete evaluation of solvent strength by combining both dilution ratio and viscosity data. The

present section deals with the first of these criteria—namely, the comparative toluene dilution ratios of pure solvents and solvent-coupler mixtures. Toluene was chosen as the diluent in these studies because it is widely used in lacquer work and because the end points obtained in the dilution ratio determination are usually more distinct with toluene than with petroleum naphtha. An interesting future study would be a comparison of the petroleum naphtha dilution ratios of these same solvents and mixtures with the toluene values presented here.

Comparative Toluene Dilution Ratios of Pure Solvents

When comparisons are made between different compounds belonging to the same chemical group, such as the members of homologous series, it is natural to attempt to correlate the observed characteristics in some general relation by which the data obtained for one or two members of the series may be extrapolated to the other members. Investigators have sought for several years to establish such a relation between the dilution ratio values of the solvents of homologous series, and some success was attained in the case of the normal 2-ketones. Thus Desparmet (*10*) related the solvent strength of these ketones to the proportion of oxygen-bearing groups in the molecule. Calvert (*6*) simplified this relation merely by comparing the dilution ratios with the percentage of oxygen present in the ketone.

Several writers have indicated that solvent strength in homologous series is related to the molecular weight of the solvents, with the members of lowest molecular weight exhibiting the greatest solvent ability. Both Mardles (*22*) and McBain (*21*), however, took pains to point out that solvent strength criteria obtained by the two methods (viscosity *vs.* dilution ratio) sometimes conflict. Davidson and Reid (*8*) observed that a proportionality between solvent strength and molecular weight did not exist in the case of the glycol-ethers (Cellosolves) when evaluated by the dilution ratio method; and Mardles (*22*) went so far as to say that "there does not appear to be any close relation between the solvent power of a liquid for cellulose esters and the molecular volume."

The data presented in this paper indicate, however, that a definite (though empirical) relation does exist, connecting the toluene dilution ratio values of the pure members of the three homologous series studied. It is most convenient, for the purpose of studying the relation, to plot the toluene dilution ratio values against the molar volumes of the solvents. The shape of the curves would not be altered much if the dilution ratios were plotted against molecular weights, since the molar volume is simply the molecular weight divided by the density of the liquid; but molar volumes are preferred because of the ease with which the concentrations of solvent (or solvent plus coupler) in moles per liter can be calculated when the dilution ratios and molar volumes are known. These three quantities are related by the following simple equation:

$$N = \frac{1}{V(DR + 1)} \qquad (1)$$

where N = mole concentration of solvent (or solvent + coupler) in moles/liter
V = molar volume, liters
DR = dilution ratio

The importance of mole concentrations in the theoretical study of the process of dissolving nitrocellulose will be developed in a subsequent paper, but this explanation will suffice to show why the dilution ratio values presented in this paper are plotted against the molar volumes of the solvents.

Three curves are plotted on Figure 1; each connects the toluene dilution ratios, at an end point of 8 per cent total solids, for the ascending members of a homologous series of solvents. An empirical relation that defines each of these curves is:

$$DR = \frac{A}{V\left(Be^{+V/k} + e^{-V/k}\right)} - 1 \qquad (2)$$

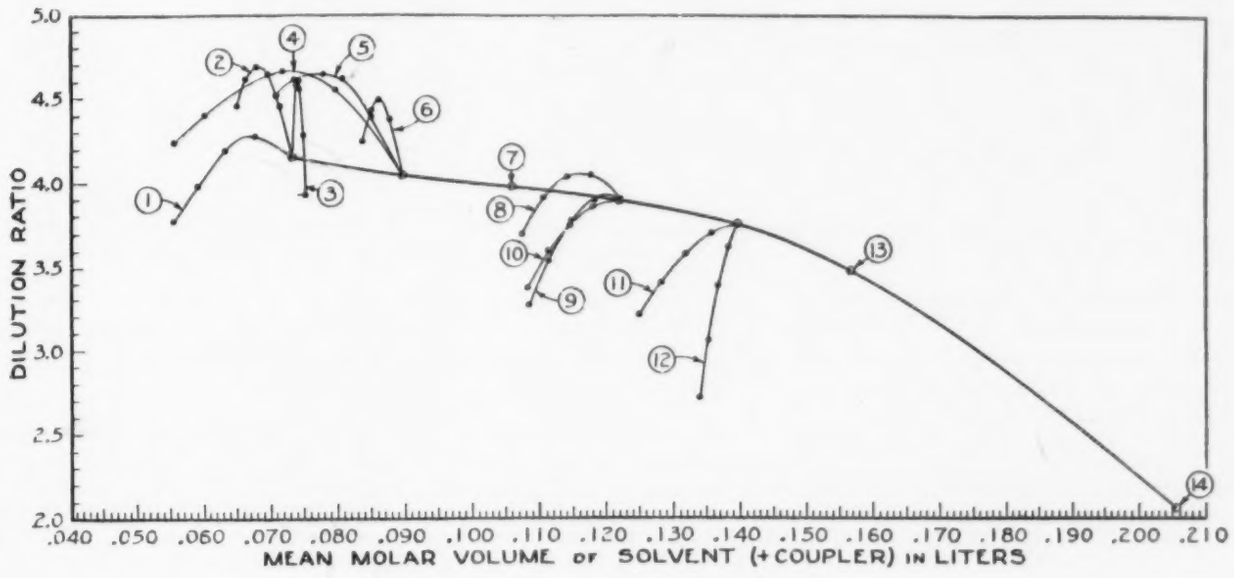


FIGURE 3. SOLVENT STRENGTH OF KETONES

1. Acetone-methanol
2. Acetone-ethanol
3. Acetone-isopropanol
4. Methyl ethyl ketone–methanol
5. Methyl ethyl ketone–ethanol
6. Methyl ethyl ketone–isopropanol
7. Methyl propyl ketone
8. Methyl butyl ketone–*n*-butanol
9. Methyl butyl ketone–isobutanol
10. Methyl butyl ketone–*sec*-butanol
11. Methyl amyl ketone–*n*-amyl alcohol
12. Methyl amyl ketone–methyl amyl alcohol
13. Methyl hexyl ketone
14. Methyl nonyl ketone

TABLE I. TOLUENE DILUTION RATIOS CORRESPONDING TO THE PERCENTAGE OF SOLVENT IN EACH OF THE BINARY MIXTURES STUDIED

Per Cent Solvent by Weight	Mean Molar Volume	Dilution Ratio	Mean Molar Volume	Dilution Ratio	Mean Molar Volume	Dilution Ratio
Methyl acetate	Methanol					
100	0.0793	2.21	....	..	....	..
90	0.0714	2.60	....	..	....	..
80	0.0651	2.85	....	..	....	..
70	0.0600	3.00	....	..	....	..
60	0.0558	3.10	....	..	....	..
50	0.0523	3.18	....	..	....	..
Ethyl acetate	Methanol		Ethanol		Isopropanol	
100	0.0978	2.65	0.0978	2.65	0.0978	2.65
90	0.0845	3.16	0.0908	2.92	0.0948	3.02
80	0.0745	3.37	0.0852	3.10	0.0921	3.20
70	0.0669	3.42	0.0801	3.22	0.0896	3.22
60	0.0607	3.42	0.0757	3.31	0.0872	3.12
50	0.0559	3.41	0.0719	3.35	0.0851	2.94
***n*-Propyl acetate**	*n*-Propanol		Ethanol			
100	0.1150	2.89	0.1150	2.89	....	..
90	0.1086	3.22	0.1038	3.18	....	..
80	0.1029	3.25	0.0948	3.29	....	..
70	0.0979	3.15	0.0874	3.30	....	..
60	0.0935	2.94	0.0812	3.26	....	..
50	0.0895	2.70	0.0760	3.22	....	..
Isopropyl acetate	Ethanol		Isopropanol			
100	0.1170	2.57	0.1170	2.57	....	..
90	0.1054	3.06	0.1105	2.92	....	..
80	0.0960	3.31	0.1048	3.03	....	..
70	0.0884	3.36	0.0998	2.97	....	..
60	0.0820	3.35	0.0954	2.85	....	..
50	0.0766	3.31	0.0914	2.67	....	..
40	0.0719	3.24	....	..	....	..
30	0.0678	3.18	....	..	....	..
***n*-Butyl acetate**	Ethanol		*n*-Butanol		Isobutanol	
100	0.1317	2.73	0.1317	2.73	0.1317	2.73
90	0.1155	3.10	0.1258	2.86	0.1260	2.77
80	0.1030	3.22	0.1204	2.88	0.1208	2.75
70	0.0935	3.24	0.1156	2.83	0.1160	2.64
60	0.0856	3.22	....	..	....	..
50	0.0791	3.20	....	..	....	..
***n*-Butyl acetate**	*sec*-Butanol		*sec*-Amyl alcohol			
100	0.1317	2.73	0.1317	2.73	....	..
90	0.1259	2.73	0.1289	2.68	....	..
80	0.1204	2.62	0.1261	2.57	....	..
70	0.1156	2.49	0.1234	2.45	....	..
60	....	..	0.1210	2.30	....	..
***n*-Amyl acetate**	*n*-Amyl alcohol		*sec*-Amyl alcohol		2-Ethylbutanol	
100	0.1482	2.15	0.1482	2.15	0.1482	2.15
90	0.1425	2.40	0.1427	2.29	0.1452	2.22
80	0.1373	2.45	0.1376	2.25	0.1423	2.04
70	0.1325	2.33	0.1329	2.07	0.1396	1.69
60	0.1282	2.15	0.1289	1.87	0.1370	1.27
Methyl amyl acetate	*n*-Amyl alcohol		Methyl amyl alcohol			
100	0.1655	1.32	0.1655	1.32	....	..
90	0.1567	1.62	0.1604	1.47	....	..
80	0.1488	1.70	0.1553	1.46	....	..
70	0.1417	1.66	0.1508	1.33	....	..
60	0.1354	1.54	0.1466	1.12	....	..

Per Cent Solvent by Weight	Mean Molar Volume	Dilution Ratio	Mean Molar Volume	Dilution Ratio	Mean Molar Volume	Dilution Ratio
Acetone	Methanol		Ethanol		Isopropanol	
100	0.0733	4.15	0.0733	4.15	0.0733	4.15
90	0.0678	4.28	0.0714	4.46	0.0736	4.41
80	0.0631	4.19	0.0697	4.64	0.0739	4.59
70	0.0590	3.98	0.0681	4.69	0.0742	4.62
60	0.0554	3.77	0.0664	4.62	0.0745	4.56
50	....	..	0.0650	4.46	0.0748	4.29
40	....	..	....	..	0.0752	3.93
Methyl ethyl ketone	Methanol		Ethanol		Isopropanol	
100	0.0897	4.05	0.0897	4.05	0.0897	4.05
90	0.0798	4.56	0.0851	4.41	0.0881	4.38
80	0.0720	4.67	0.0809	4.62	0.0866	4.50
70	0.0656	4.56	0.0771	4.65	0.0852	4.43
60	0.0602	4.40	0.0736	4.62	0.0838	4.25
50	0.0556	4.24	0.0705	4.49	....	..
Methyl *n*-propyl ketone						
100	0.1062	3.98	....	..	....	.
Methyl *n*-butyl ketone	*n*-Butanol		Isobutanol		*sec*-Butanol	
100	0.1222	3.90	0.1222	3.90	0.1222	3.90
90	0.1182	4.05	0.1185	3.91	0.1184	3.87
80	0.1144	4.04	0.1150	3.78	0.1149	3.76
70	0.1108	3.92	0.1117	3.54	0.1115	3.60
60	0.1076	3.70	0.1087	3.27	0.1084	3.38
Methyl *n*-amyl ketone	*n*-Amyl alcohol		Methyl amyl alcohol			
100	0.1400	3.76	0.1400	3.76	....	..
90	0.1360	3.70	0.1385	3.63	....	..
80	0.1321	3.58	0.1370	3.39	....	..
70	0.1284	3.41	0.1356	3.06	....	..
60	0.1251	3.22	0.1342	2.72	....	..
Methyl *n*-hexyl ketone						
100	0.1568	3.48	....	..	....	..
Methyl *n*-nonyl ketone						
100	0.2058	2.06	....	..	....	..
Methyl Cellosolve	*n*-Butanol		Methyl Cellosolve acetate		Butyl Cellosolve	
100	0.0789	4.00	0.0789	4.00	0.0789	4.00
90	0.0802	4.24	0.0815	3.77	....	..
80	0.0815	4.30	0.0842	3.63	0.0862	4.16
70	0.0827	4.25	0.0872	3.51	....	..
60	0.0840	4.03	0.0904	3.38	0.0946	4.32
40	....	..	....	..	0.1046	4.37
20	....	..	....	..	0.1166	4.17
0	....	..	....	..	0.1312	3.50
Cellosolve	*n*-Butanol		Cellosolve acetate			
100	0.0970	4.90	0.0970	4.90	....	..
90	0.0963	4.81	0.0999	4.85	....	..
80	0.0957	4.56	0.1026	4.68	....	..
70	0.0951	4.15	0.1057	4.36	....	..
60	0.0945	3.69	0.1091	3.98	....	..

where e = exponential or Naperian base
A, B, k = constants whose values are given on Figure 1

Figure 1 shows that the dilution ratio values of the pure acetic esters and of the pure ether-alcohols pass through maxima, whereas the values for the pure ketones do not. This, perhaps, explains why no simple relation has been devised to connect the members of the first two groups, although the shape of the curve connecting the normal 2-ketones lends itself readily to simpler empirical treatment.

The second section of this paper shows that the viscosities of 8 per cent solutions of nitrocellulose in the ascending pure members of each of these homologous series increase regularly as the molar volumes of the solvents become larger. Since no minimum viscosities are observed corresponding to the maximum dilution ratios shown on Figure 1, it is obvious that these two criteria are not measures of the same phenomenon. There is no theoretical reason why the two methods should be expected to give corresponding results, but the fact that in studies of mixtures of solvent and coupler the composition of maximum dilution ratio often occurs very close to the composition of minimum viscosity has led to some confusion in this regard.

It is scarcely necessary to point out that the data in regard to the pure acetic esters are of theoretical interest only, since the commercial esters usually contain a considerable proportion of an alcohol which markedly affects the dilution ratio values, as will be shown subsequently. The data for the pure ketones are of more practical interest since all of the commercially available ketones examined in this study are offered to the trade in a high degree of purity except methyl *n*-butyl ketone, which is sold as a mixture containing approximately 88 per cent of the ketone. The ether-alcohols are offered to industry in almost as high a degree of purity as that of the pure compounds used in this study.

Comparative Toluene Dilution Ratios of Solvent-Coupler Mixtures

In addition to the relations studied regarding the solvent strengths of the pure members of homologous series of solvents, a number of binary mixtures of many of these pure solvents with various pure alcohols were also investigated. In order to display all of the relations involving each class of solvents on a single chart, it was necessary to plot all of the dilution ratios against a common variable. For this purpose the mean molar volume of solvent plus coupler was chosen, which is defined by the following expression:

$$V = \frac{Ns \cdot Vs + Nc \cdot Vc}{Ns + Nc} \qquad (3)$$

where V = mean molar volume of mixture, liters
Vs = molar volume of solvent, liters
Vc = molar volume of coupler, liters
Ns = mole concentration of solvent, moles/liter
Nc = mole concentration of coupler, moles/liter

Inspection of this formula shows that the mean molar volume is simply the sum of the parts of the molar volumes of solvent and of coupler represented by the mole proportions (mole fractions) in which these two components are present.

When the dilution ratios of various mixtures of solvent and coupler, at an end point of 8 per cent total solids, were plotted against the corresponding mean molar volumes of the mixtures, the groups of curves shown on Figures 2 to 5 were obtained. A mathematical analysis of these data brought out the surprising observation that almost all of the curves relating the dilution ratios of binary mixtures of solvent and alcohol with their mean molar volumes also conform to the same mathematical expression (Equation 2) for the pure solvents. The only cases among the thirty-four binary mixtures studied that were not defined by Equation 2 were those of ether-alcohol esters mixed with ether-alcohols, and the two mixtures methyl acetate–amyl acetate, and Cellosolve[1]–butyl Cellosolve.

Figures 2 to 5 show that the curves of many of the binary mixtures of solvent and coupler pass through maxima. This means that with such mixtures there is an optimum composition which gives the maximum tolerance for toluene. The data presented in this paper serve to define the optimum proportions for twenty-five such mixtures of solvent and coupler. In the remaining nine mixtures either the greatest proportion of alcohol used was not sufficient to reach the maximum dilution ratio or else no mixture of improved solvent strength resulted from combining the two liquids.

The effect of coupler action is clearly more pronounced in the case of couplers of low molecular weight than it is with higher alcohols. Since solvents and couplers of approximately equivalent evaporation rate were used in each combination studied, the greatest improvement in solvent strength due to coupler action appears on the left or low molecular weight portion of Figures 2, 3, and 4.

Another interesting comparison may be noted in the case of the five alcohols used to couple *n*-butyl acetate (Figure 2). Here ethyl alcohol exerts the greatest coupling action. *n*-Butanol is second, isobutanol is third, and *sec*-butanol is fourth. *sec*-Amyl alcohol, however, is a poor fifth, exhibiting no combination of improved solvent strength whatever. With mixtures of three of these alcohols and methyl *n*-butyl ketone, the coupling effect is not in the same order (Figure 3). *n*-Butanol is the most effective, as before, but isobutanol has a slightly greater coupling effect than *sec*-butanol when the former is present in limited amount. The secondary compound, however, gives the higher dilution ratio when the proportion of alcohol in the mixture is greater.

[1] Trade-marked name (ethyl ether of ethylene glycol).

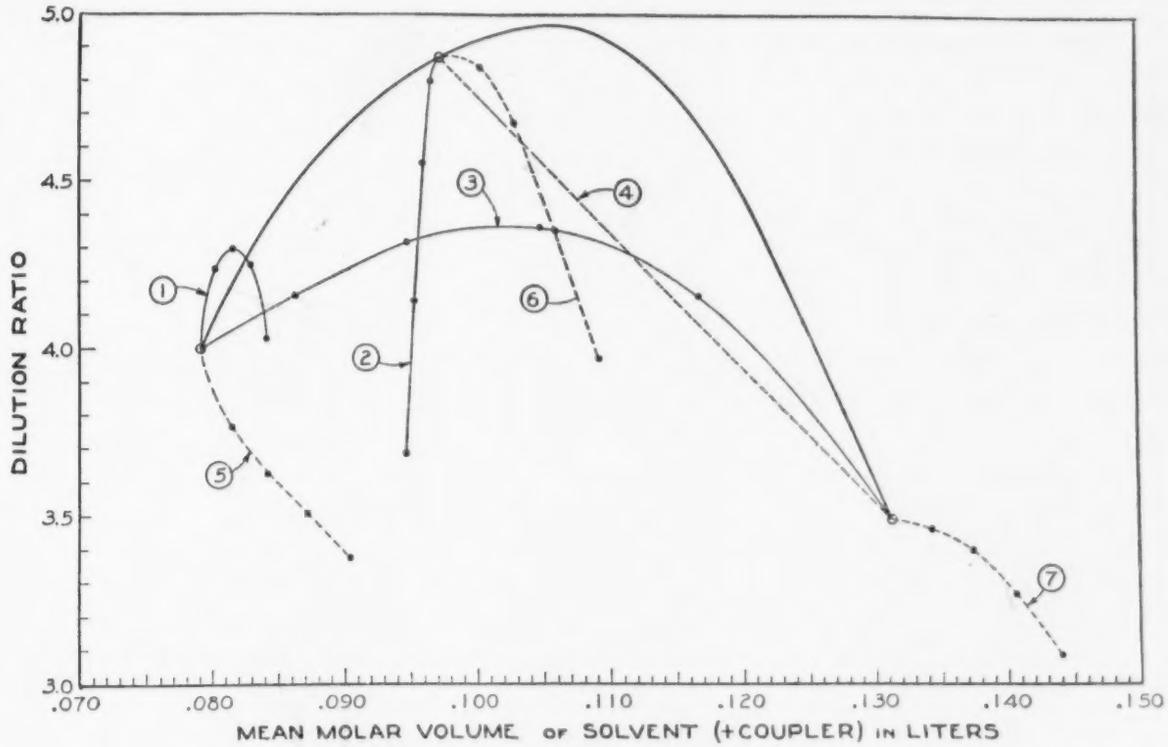


FIGURE 4. SOLVENT STRENGTH OF ETHER ALCOHOLS

Ether-Alcohol Coupler Combinations
1. Methyl Cellosolve–*n*-butanol
2. Cellosolve–*n*-butanol
3. Methyl Cellosolve–butyl Cellosolve

Mixtures Not Defined by Equation 2
4. Cellosolve–butyl Cellosolve
5. Methyl Cellosolve–methyl Cellosolve acetate
6. Cellosolve–Cellosolve acetate
7. Butyl Cellosolve–butyl Cellosolve acetate

Figure 4 shows the toluene dilution ratios of the ether-alcohols; several curves are included of combinations of ether-alcohols and ether-esters. These are indicated as broken curves because they are not defined by Equation 2. These combinations, apparently, cannot be considered as mixtures of solvent and coupler, and in no instance was any improved solvent strength observed. Normal coupler action was observed, however, in the case of the combination of this compound, more properly described as methyl isobutyl carbinol acetate, falls on the curve connecting the first five members of the series of pure normal acetic esters and hence is included; the assumption is that in the case of esters of such high molecular weight, the structural arrangement of the molecule has but slight effect on the toluene dilution ratio.

Isopropyl acetate was studied separately (Figure 5) since it could not be included properly in the homologous series of

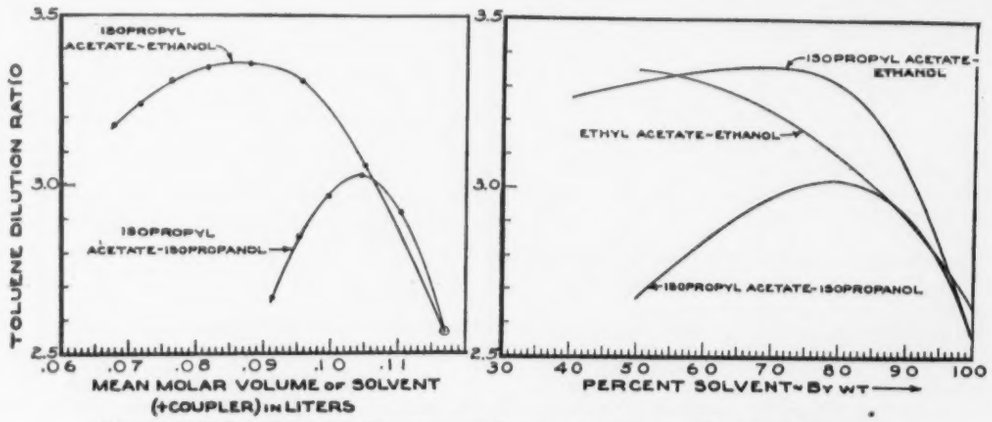


FIGURE 5 (*left*). SOLVENT STRENGTH OF ISOPROPYL ACETATE–COUPLER MIXTURES
FIGURE 6 (*right*). SOLVENT STRENGTH OF SOLVENT–COUPLER MIXTURES

methyl Cellosolve and *n*-butanol and likewise with the combination of methyl Cellosolve and butyl Cellosolve; the latter gave a maximum toluene dilution ratio of about 4.4, which is considerably higher than that of either component. No improved solvent strength was observed with mixtures of Cellosolve and *n*-butanol, nor with mixtures of Cellosolve and butyl Cellosolve. It is likewise noteworthy to observe that no increased solvent strength was evident in mixtures of pure methyl acetate and pure *n*-amyl acetate (Figure 2).

The alcohols used as couplers throughout this study have been anhydrous alcohols so that all of the liquids employed should be of the highest practicable purity. However, it has been observed from other work not reported in this paper that the coupling effect of ethyl alcohol is not greatly altered if the constant-boiling mixture of ethanol and water (95 per cent ethanol) is substituted for the anhydrous alcohol, except in the case of the low-boiling ketones. For example, there is little difference in the case of mixtures of ethyl acetate or butyl acetate and either the wet or dry ethanol, but with acetone or methyl ethyl ketone an appreciable diminution in the tolerance for diluent is observed, especially in mixtures containing higher proportions of the 95 per cent ethanol.

In order to present the data on coupler action in a form more useful to the lacquer formulator, Table I is included.

To elucidate the data further, Figures 2 to 5 are so constructed that the indicated points in each combination of solvent and coupler represent regular intervals of 10 per cent each in the proportion of the components by weight. Thus the dilution ratio of each pure solvent (100 per cent) lies on the smooth curve connecting the members of the homologous series in which the solvent is included. The next point on each curve of binary mixtures is 90 per cent solvent, then 80 per cent, and so on to 50 per cent or less in each case. The point marked ⊕ that appears on some of the curves of Figure 2 indicates the composition of the commercial product.

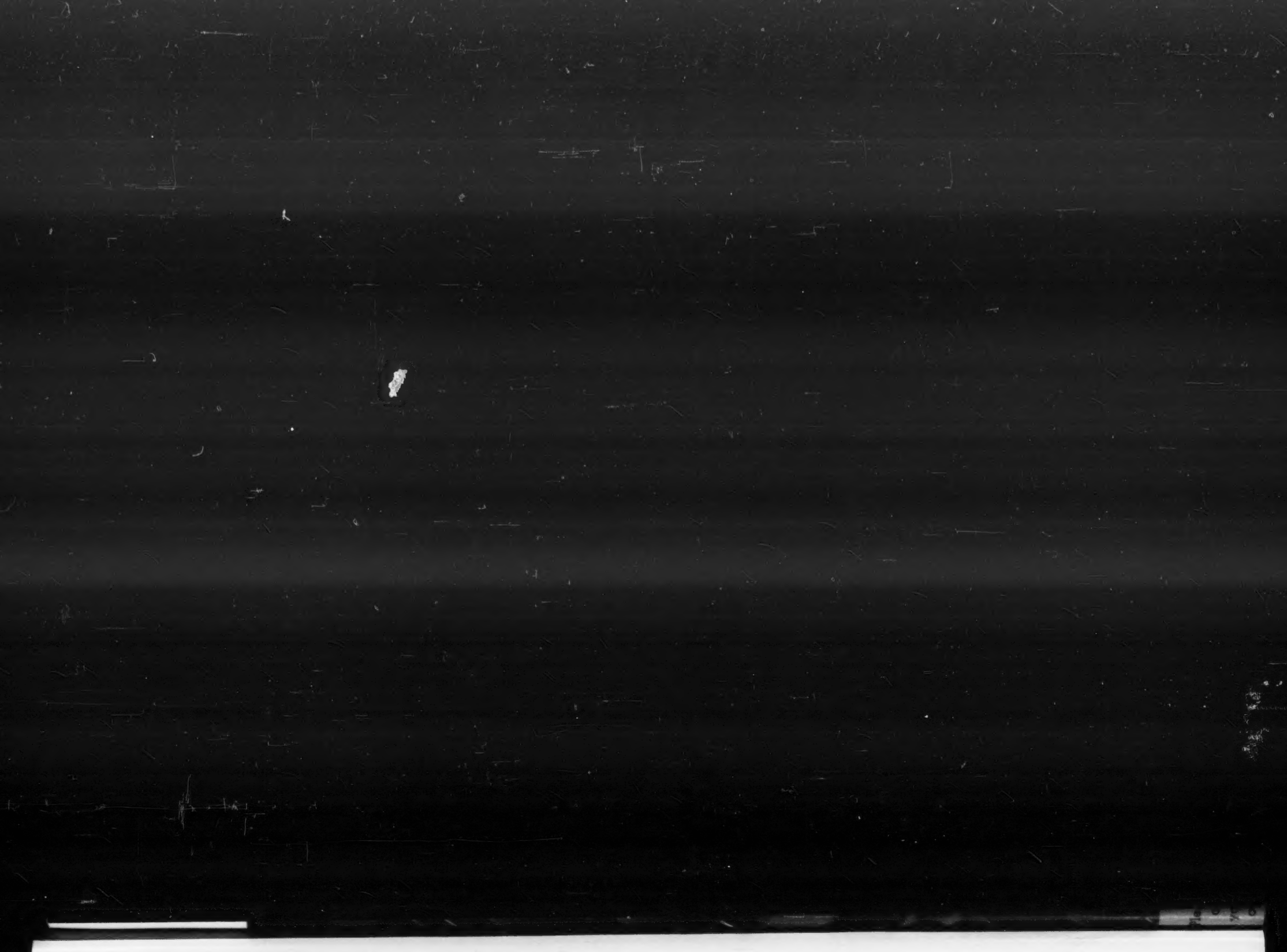
Since this study is concerned primarily with the solvents belonging to the normal homologous series, the iso- and secondary compounds are not shown on Figures 2, 3, and 4 except in the case of methyl amyl acetate. The dilution ratio of normal esters, and some interesting results were observed in regard to the effect on the solvent strength caused by coupling the pure compound with different alcohols. Thus, anhydrous ethanol is much to be preferred over anhydrous isopropanol as a coupler for pure isopropyl acetate. Furthermore, because of the steeper rise of the dilution ratio–composition curve (Figure 6), the combination isopropyl acetate–anhydrous ethanol reaches a toluene dilution ratio of 3.3 at 80 per cent solvent whereas the equivalent figure with ethyl acetate–anhydrous ethanol is not reached until the solvent content has been reduced to 60 per cent.

TABLE II. ANALYTICAL DATA

Solvent	Boiling Range[a] at 760 Mm.	Sp. Gr., 20°/20° C.	Purity	Viscosity, 20° C.
	° C.		%	*Centipoises*
Methyl acetate	55.0– 56.6	0.9350	99.3	0.38
Ethyl acetate	76.8– 77.8	0.9020	99.2	0.45
n-Propyl acetate	100.2–102.9	0.8894	99.3	0.58
Isopropyl acetate	88.4– 89.4	0.8730	99.9	0.58
n-Butyl acetate	124.8–126.1	0.8820	99.5	0.74
n-Amyl acetate	146.7–149.7	0.8778	98.9	0.95
Methyl amyl acetate	143.9–146.4	0.8597	99.6	0.96
Acetone	55.0– 57.0	0.7930	99.5	0.32
Methyl ethyl ketone	78.6– 79.9	0.8060	99.5	0.42
Methyl *n*-propyl ketone	100.1–102.6	0.8090	98.8	0.50
Methyl *n*-butyl ketone	124.5–127.8	0.8145	99.5	0.63
Methyl *n*-amyl ketone	146.7–150.7	0.8166	99.1	0.81
Methyl *n*-hexyl ketone	167.5–173.5	0.8200	98.1	1.06
Methyl *n*-nonyl ketone	228	0.8280	..	2.40
Methyl Cellosolve	123.1–124.3	0.9660	99.7	1.72
Cellosolve	133 3–136.3	0.9302	99.5	2.09
Butyl Cellosolve	164.1–171.9	0.9021	99.2	3.31
Methanol	64.7– 65.9	0.7940	99.5	..
Ethanol	78.0– 78.5	0.7913	99.8	..
Isopropanol	82.1– 83.7	0.7867	99.9	..
n-Propanol	96.6– 97 6	0.8053	99.6	..
n-Butanol	116.9–118.3	0.8102	99.6	..
Isobutanol	107.2–110.2	0.8030	97.7	..
sec-Butanol	99.1–100.4	0.8075	94.4	..
n-Amyl alcohol	136.7–138.5	0.8183	98.9	..
sec-Amyl alcohol	117 0–121.0	0.8111	97.4	..
2-Ethylbutanol	144.8–152.8	0.8347	97.9	..
Methyl amyl alcohol	130.8–132 6	0.8073	99.6	..
Methyl Cellosolve acetate	140.6–144.1	1.0075	99.6	..
Cellosolve acetate	153 9–156.9	0.9744	99.9	..
Butyl Cellosolve acetate	186.9–191.9	0.9414	99.7	..

[a] A. S. T. M. method D268-33.

(*Continued on page 52*)



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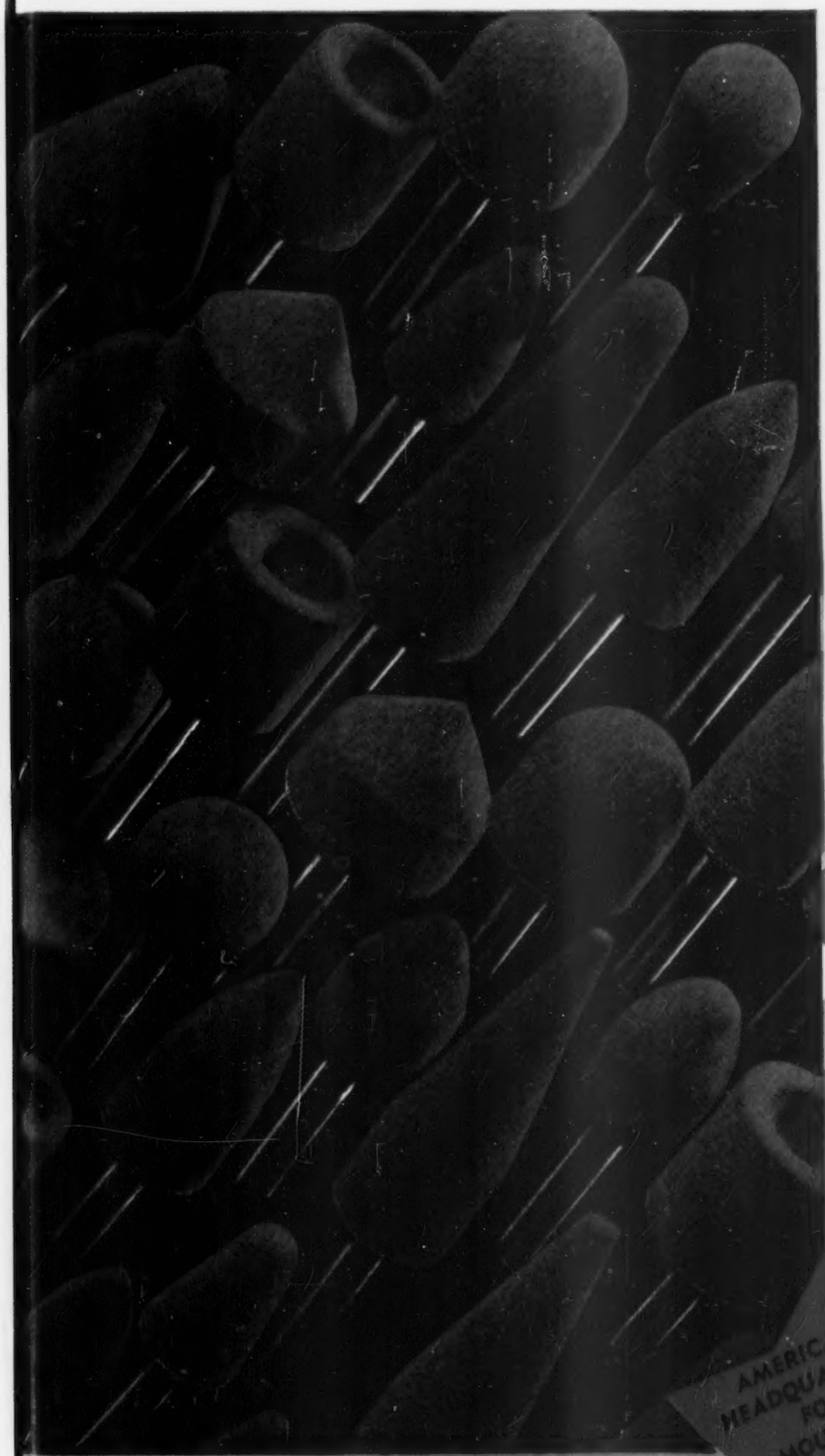

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(*Continued from page 50*)

An important consideration emphasized by this study is the effect on the dilution ratio values of small quantities of impurities, particularly alcohols. As long ago as 1914 Schwarz (*26*) pointed out that the values for the solvent strength of solvents for nitrocellulose can be significant only if their purities are exactly indicated. Keyes (*18*) in 1925 stated that the improved solvent strength exhibited by solvents of commercial purity was due to the alcohol impurities, and many other early investigators have pointed out the effect of impurities on the solvent ability of solvents for nitrocellulose. In spite of this adequate background, however, the published values of dilution ratios have seldom indicated the purity of the solvents used in making the determinations; this factor has served to discredit somewhat the reliability of the dilution ratio determination.

In the present study great pains were taken to obtain solvents of the highest practicable purity, and this effort constituted the major part of the experimental work involved in obtaining the data reported here. Table II summarizes the analytical data of each of the solvents, diluents, and couplers employed.

In order to obtain comparable figures in all cases, the same blend of nitrocellulose was used throughout. This was Hercules R. S. half-second nitrocellulose lot 6041, 12.10 per cent nitrogen content. Unfortunately, slight differences in the nitrocellulose used for the dilution ratio determination give slightly different results, and therefore some of the values reported here do not check absolutely the values given in a previous paper by the author on this subject (*11*) in which the nitrocellulose used was Hercules R. S. half-second nitrocellulose, lot 4203.

Summary

1. The solvent strength of the pure members of the homologous series of acetic esters, ketones, and ether-alcohols has been evaluated by the toluene dilution ratio method. The values for the esters and the ether-alcohols are shown to pass through maxima as the homologous series is ascended, but in the case of the ketones there is a continual diminution in solvent strength as the size of the molecules increases. The same empirical equation is shown to define the curves connecting the dilution ratio values of the solvents of each class, using appropriate constants for each curve.

2. The change in toluene dilution ratio with the proportion of solvent is shown for thirty-four binary mixtures of solvent and coupler; it is apparent that normal alcohols of low molecular weight are, in general, most effective in improving the toluene tolerance of the mixtures.

The curves connecting the toluene dilution ratio with the composition of most of the binary mixtures studied can also be defined by the same mathematical expression that relates the pure members of homologous series, when the appropriate constants are found for each curve.

3. Isopropyl acetate–ethanol is a much stronger solvent mixture than isopropyl acetate–isopropanol and is even slightly more desirable than ethyl acetate–ethanol, since equivalent toluene tolerance occurs with the isopropyl ester when a smaller proportion of ethanol is present.

(*See page 57 for bibliography*)

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About Brushes and Brushing....

By JOHN M. TRENTON

THE finishes on many of the war items being produced today are applied by brush and because our war production is so great, there are probably more brushes being used in industry than ever before. Given below is a group of true-or-false questions from which pertinent information on the construction, use and care of brushes may be obtained.

Question—The Egyptians were the first to use brushes extensively for applying liquid coatings.

True ( ) False ( )

Answer—True. Records show that the Egyptians used reeds, softened in water and split into fibres, for brushes.

Question—New brushes are broken in most easily by soaking them in warm water for a day or two.

True ( ) False ( )

Answer—False. Water can make bristles soft and flabby. Such treatment may ruin a good brush.

Question—Camel hair brushes are made from hair of the Asiatic camel.

True ( ) False ( )

Answer—False. So-called camel hair, widely used for artists' brushes, striping and lettering brushes, etc., comes from the tails of Russian and Siberian squirrels.

Question—Flat brushes have come into general use only within the last hundred years.

True ( ) False ( )

Answer—True. Until early in the nineteenth century most brushes were round or almost round in shape. The flat brush, so well known and popular today, is quite modern.

Question—Brushes should never be left standing in a paint pail.

True ( ) False ( )

Answer—True. The bristles may become bent by allowing the brush to rest on the bottom of the pail for any time. If it is necessary to leave the brush in the pail, suspend it so that it is clear of the bottom.

Question—It is impossible to obtain a brush which will not shed its bristles.

True ( ) False ( )

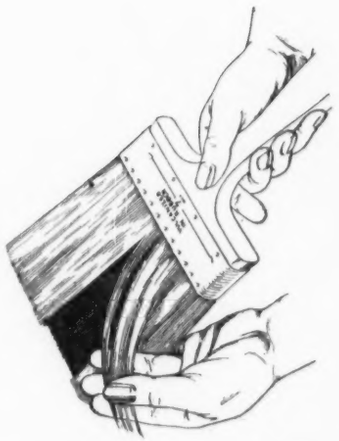
Answer—False. No well made brush should shed bristles except, perhaps, a few when it is new and first used. If a brush continuously drops bristles, it is probably of inferior quality or is defective. To remove the few loose bristles which a new brush may have, dip it into the material and draw it gently across a rough surface a few times.

Hog Bristle Showing Split and Tapered End

Question—Pig bristle is the only animal hair used for paint brushes which has a split end.

True ( ) False ( )

Answer—True. The split end, or flag as it is called, of the pig bristle is the reason it is so well suited for paint brushes. It is this branching end which gives such great paint carrying capacity.



Casing—An Outer Layer of Different Type or Color Bristle

Question—A cased brush is one which is made with an outer layer or casing of bristles differing from the bristles in the center.

True ( ) False ( )

Answer—True. Brushes are sometimes cased for appearance and sometimes to secure a specific effect as, for example, when long stiff bristles are used in the outer layer to minimize spattering.

Question—Most brush handles are made of well aged hickory.

True ( ) False ( )

Answer—False. Many different kinds of wood are used for brush handles. Maple and beech are two which are widely used. For large brushes where weight is a factor, light woods such as basswood are employed.

Illustrations courtesy of Pittsburgh Plate Glass Co. and American Painter and Decorator.

Question—The best brushes are made of bristles which are all the same length.

True ( ) False ( )

Answer—False. Brushes are made of bristle of various lengths so that new ends (flags) come into play as the brush wears down.

Question—Moths sometimes attack brushes.

True ( ) False ( )

Answer—True. Moths may attack brush bristles. When brushes are stored, it is wise to use some moth preventive.

Question—China and Russia are sources of large quantities of pig bristle.

True ( ) False ( )

Answer—True. Bristle from these countries is particularly suited for paint brushes.

Question—Flat paints must be spread out, that is, each brushful must be worked in thoroughly.

True ( ) False ( )

Answer—False. This technique is more appropriate to oil paints, such as exterior house paints. Flat paints are applied to a small area at a time without too much brushing so that the paint will level and not leave brush marks.

Question—In general, a brush should be gripped lightly in the hand in the manner in which a pencil or pen is held.

True ( ) False ( )

Answer—True. This grip allows the brush to be drawn across the surface at the proper angle. It is comfortable and allows easy change in the direction of brushing.

Question—Brushes should be stored in a warm place in which the air is quite moist.

True ( ) False ( )

Answer—False. Brushes should be stored in a cool place which will neither dry out the bristles nor cause damp mold. They should be carefully wrapped and stacked so that the bristles do not become bent.

Question—It is not good practice to use the same brush for both varnish and paint.

True ( ) False ( )

Answer—True. For best results, a varnish brush should be used exclusively for varnish. Good varnishing depends to a great extent on clean brushes and it is sometimes difficult to clean a brush which has been used for paint sufficiently well to use it for varnish.

Question—When painting narrow sections with a wide brush, the brush should be held edgewise.

True ( ) False ( )

Answer—False. Using a brush edgewise may round the corners and ruin it. Always use the flat side. If a brush is too wide for the section being painted, use a narrower one.

A Good Brush Which Has Been Ruined by Lack of Care

● NOT A STUNT or freak, these two complete A-F wash, rinse and dry units were designed in one housing to save floor space. With overhead trolley conveyor in one unit it washes metal parts in a vertical position, and with a wire mesh conveyor in the other it washes metal parts in a horizontal position.

While each washing operation can be performed separately or both at the same time, the two machines are shielded from each other so that washing in one does not affect the other. A great economy is provided by both machines drawing their solution from the same tank. Only one tank must be heated.

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Solvents In Industry

Methyl Isobutyl Ketone

(Hexone, 4-methylpentanone-2)

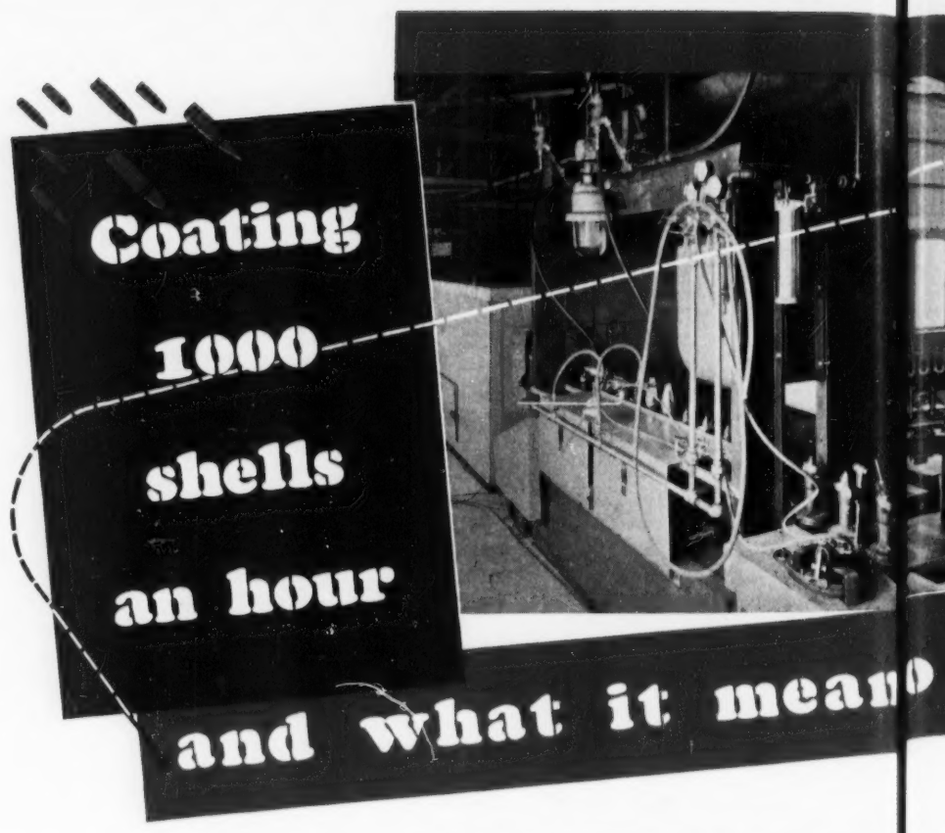
Methyl isobutyl ketone is a water white and flammable liquid of the ketone group of organic compounds. It possesses a characteristic ketonic odor. It has the chemical formula $(CH_3)_2CHCH_2COCH_3$ and its molecular weight is 100.16.

Methyl isobutyl ketone is classed as a medium boiling solvent. It is miscible with most of the organic solvents and is a good solvent for many resins, waxes, and gums and oils, of both natural and synthetic varieties. By itself, methyl isobutyl ketone is not a solvent for cellulose acetate but when mixed with ethylene dichloride becomes a good solvent. Its solvent power for nitrocellulose compares favorably with that of normal butyl acetate as based on dilution ratio and viscosity of solution. A list of the solubilities of various materials in methyl isobutyl ketone is given below.

Pure methyl isobutyl ketone dissolves in water to the extent of 1.7 per cent by weight at 25° C. Water is soluble in it to a maximum of 1.9 per cent by weight at 25° C. A constant boiling mixture of water and methyl isobutyl ketone, containing 75.7 per cent by weight of the latter, boils at 87.9° C.

Pure methyl isobutyl ketone is listed as having a specific gravity of 0.8004 (approximately 6.68 pounds per gallon at 20° C.) at 20/4° C. Its boiling point at 760 mm. mercury pressure is 115.9° C. and its freezing point is 83.5° C. Its vapor pressure varies from 15.2 mm. of mercury at 20° C. to 43.5 mm. at 40° C. Its evaporation rate is slightly higher than that of normal butyl acetate (1.5 as compared with 1.0 for normal butyl acetate) but is considerably lower than that of acetone, the lowest of the ketonic series. The closed cup flash point of methyl isobutyl ketone is 60° F., slightly higher than that of ethyl alcohol. Its coefficient of expansion is 0.000625 per °F. Its specific heat and latent heat of vaporization are 0.46 calories per gram at 20° C. and 87 calories per gram respectively.

As mentioned above, the solvent power of methyl isobutyl ketone for nitrocellulose compares favorably with that of normal butyl acetate. Based on ½ second R. S. nitrocellulose, its dilution ratio with respect to toluol is 3.9. With respect to low aromatic petroleum diluent it is 1.0. The values for normal butyl acetate, 90 per cent grade, are 3.0 and 1.2 respectively.



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HERE'S HOW IT'S DONE: The ingenious machine that attains this speed is the brain child of BINKS Engineers in collaboration with Army Engineers and the Government Contractor responsible for the operation of the plant.

The shell parts to be finished are placed manually on spindles which are mounted on a long conveyor chain. Simple masking rings and plugs are used to protect threads from becoming coated in the finishing process. The spindles with their loads first pass through a preheating oven which conditions the shells for finishing by removing all traces of moisture. From this oven the spindles carry the shells directly into a BINKS Dynaprecipitor Water Wash Spray Booth. Here the spindles

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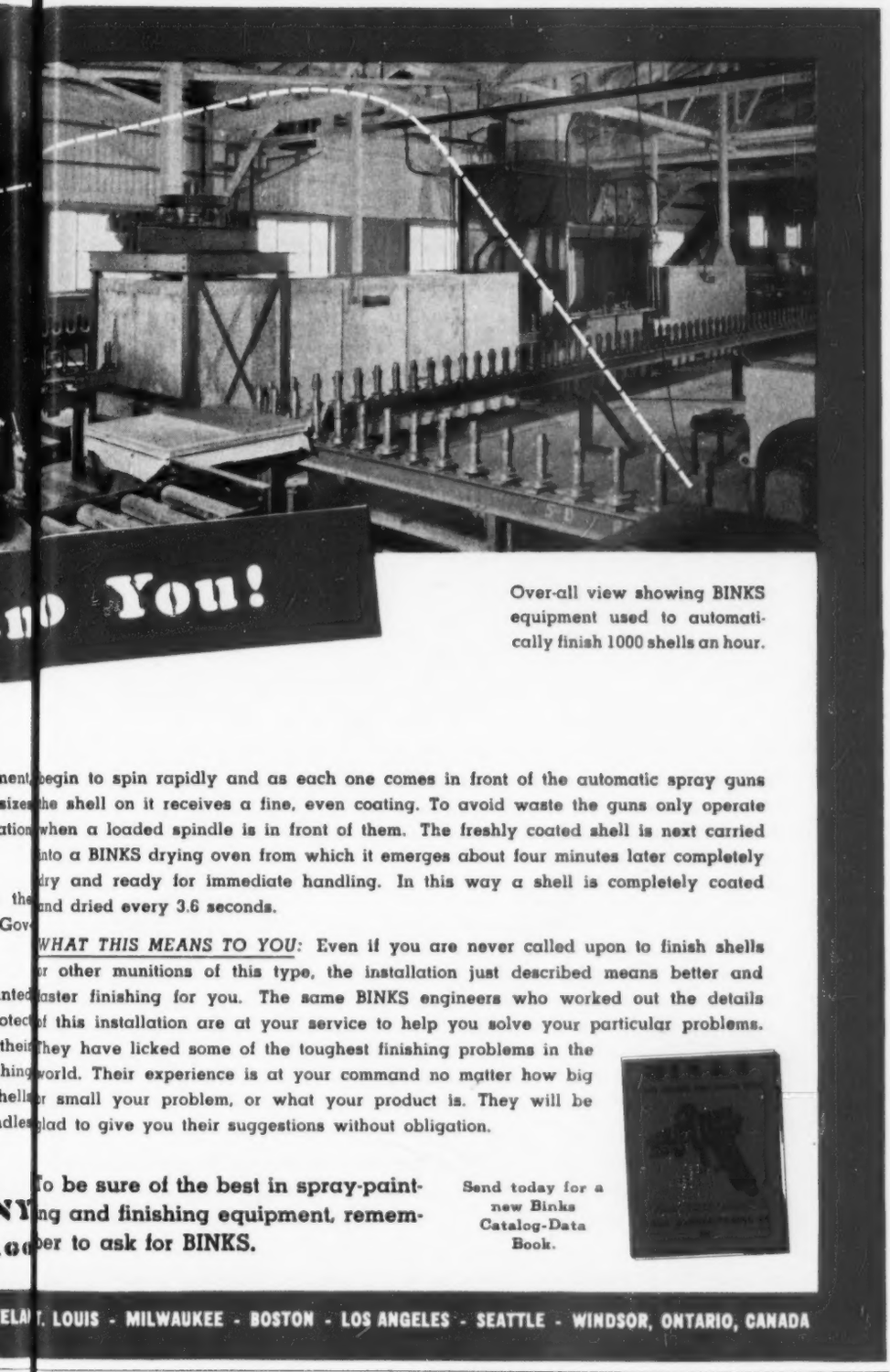
Uses

Methyl isobutyl ketone is suitable for use in extraction processes and other applications where a medium boiling and stable ketone is desired. It can be used in place of esters in lacquer solvents where the odor of esters is objectionable or it may be used in combination with esters. It is especially applicable as a solvent in vinyl type finishing materials where esters cannot be employed because of tendencies to increase in viscosity and to gel on aging. Methyl isobutyl ketone has been authorized for use as a denaturant in certain denatured alcohol formulae.

Physiological Properties

Like most organic solvents, methyl isobutyl ketone removes the natural oils from the skin when in contact with it and may produce dryness, cracking of the skin and irritation. Methyl isobutyl ketone is a relatively new solvent and recorded data on its physiological effects are not extensive. However, it may be said that precautions such as proper ventilation of rooms in which it is used, should be taken, as with all organic solvents.



o You!

Over-all view showing BINKS equipment used to automatically finish 1000 shells an hour.

egin to spin rapidly and as each one comes in front of the automatic spray guns he shell on it receives a fine, even coating. To avoid waste the guns only operate when a loaded spindle is in front of them. The freshly coated shell is next carried nto a BINKS drying oven from which it emerges about four minutes later completely ry and ready for immediate handling. In this way a shell is completely coated nd dried every 3.6 seconds.

WHAT THIS MEANS TO YOU: Even if you are never called upon to finish shells r other munitions of this type, the installation just described means better and aster finishing for you. The same BINKS engineers who worked out the details f this installation are at your service to help you solve your particular problems. hey have licked some of the toughest finishing problems in the world. Their experience is at your command no matter how big r small your problem, or what your product is. They will be lad to give you their suggestions without obligation.

o be sure of the best in spray-painting and finishing equipment, remember to ask for BINKS.

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Specifications

The following are data on two grades of commercially available methyl isobutyl ketone.

	95% Grade	99% Grade
Purity	Not less than 95% by wt.	Not less than 99% by wt.
Acidity	Not more than 0.02% as acetic acid.	Not more than 0.02% calculated as acetic acid.
Color	Water white.	Water white.
Boiling Range	at 760 mm. pressure: Below 113° C.—none. Above 119° C.—none.	ASTM Spec. D 268/33: Below 115° C.—none. Above 117° C.—none.
Specific Gravity	0.799 - 0.804 at 20/20° C.	0.799 - 0.804 at 20/20° C.
Weight	6.67 pounds per gallon at 20° C.	6.68 pounds per gallon at 20° C.
Water	———	Miscible without turbidity with 19 volumes of 60° Be. gasoline at 20° C.

Solubility of Various Materials in Methyl Isobutyl Ketone

Beeswax	Partly Soluble
Benzyl Cellulose	Soluble
Carnauba Wax	Insoluble
Cellulose Acetate	Insoluble
Dammar Gum (dewaxed)	Soluble
Elemi	Soluble
Ester Gum	Soluble
Ethyl Cellulose	Soluble
Gum Accroides	Partly Soluble
Kauri Gum	Partly Soluble
Linseed Oil (raw)	Soluble
Mastic	Soluble
Paraffin Wax	Partly Soluble
Pontianac	Partly Soluble
Sandarac	Soluble
Shellac	Insoluble
Tragacanth	Insoluble

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(Continued from page 52)

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Conveyors Save Space in Aircraft Plant

By FRANK M. BATES

Chief Plant Engineer, Fleetwings, Inc.

The area required for finishing operations on sheet-metal parts is reduced by installing conveyor systems which use the space near the plant ceiling.

WHEN floor space is at a premium, and up is the only direction left to go, it takes some tricky handling to get good production on sheet-metal parts and assemblies.

In increasing production seven times over in the past year, Fleet-wings, Inc., had to solve the same problems which every aircraft manufacturer has in finishing huge quantities of detail sheet-metal parts and assemblies of comparatively light weight but of large area.

Detail aluminum alloy parts require protective coats of primer before going into final assemblies: metal assemblies require protective coatings and, finally, fabric coated surfaces require doping. Drying time runs from a few minutes for finishing detail parts to three days for drying doped surfaces. The number of coats, length of drying time, the size and number of parts caused large amounts of floor space to be used.

Detail parts originally were laid in wire racks for spraying. Since presses could turn out parts quickly, racks of parts under production pressure accumulated rapidly and used up floor space at an alarming rate. Similarly, fabric surfaces were laid on trestles for spraying, and the three-day drying time created a space bottleneck in the doping room.

Since all Fleetwings' departments had grown to the point where there was no more floor space available, it was decided to rearrange facilities and utilize conveyor systems to speed up finishing operations and provide drying and storage space. The latter was obtained without adding to the floor area by utilizing waste space near the roof.

The solution for prime coating detail parts was to use a dip tank for most parts, retaining the spray booths for those which would tend to collect primer in low spots when drying on a conveyor. The arrangement shown in Fig. 1 is capable of handling 6,500 parts per eight-hour day. The sequence of operations which gives Alclad parts a good surface for paint adhesion is as follows:

1. Remove light oils and greases in tank No. 1 which contains a standard alkaline cleaner held at 180 F. If heavy greases or drawing compounds are present, a degreaser is used instead.
2. Rinse in tank No. 2, hot water at 165-170 F.
3. Dip in 5 percent chromic acid solution in tank No. 3, 130 F., for five minutes.
4. Rinse in tank No. 5, water at 200 F. to give a quick dry. For parts which are to be anodized, the No. 4 tank is used instead of No. 3. This is the standard 3 percent solution treatment at 95± 4 F. for 30 minutes.
5. Fans blow water from parts after which they are placed on racks to be carried through an infra-red

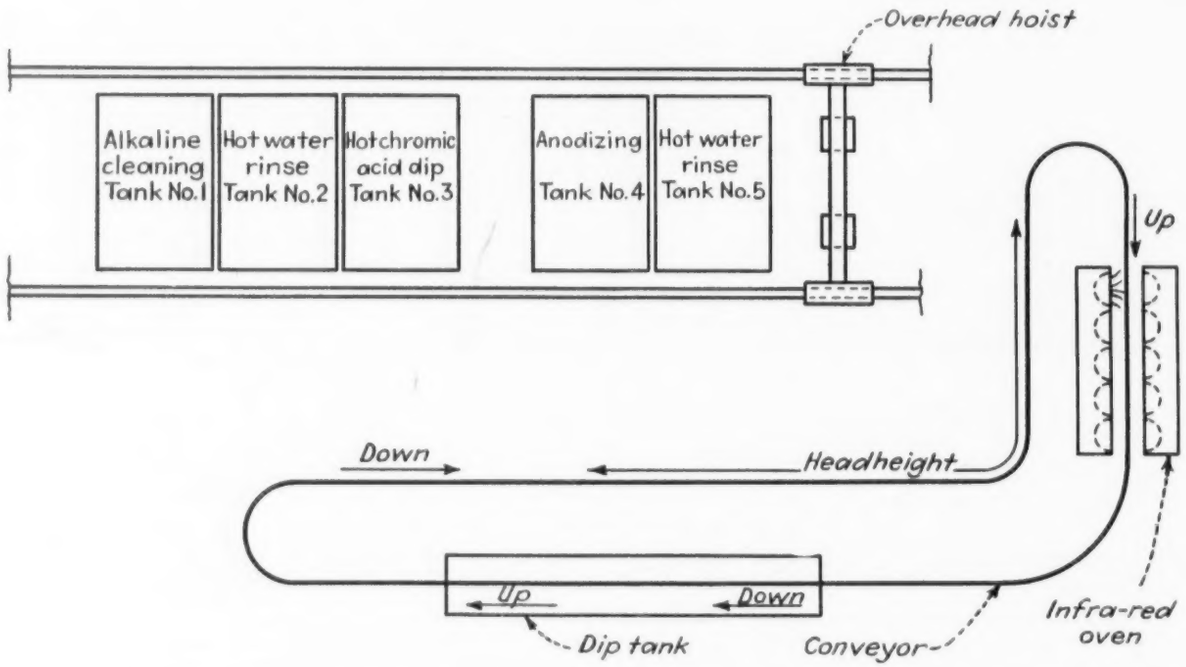


Fig. 1—A compact arrangement of cleaning, anodizing, chromatizing and primer dip tanks is possible with a single track conveyor.

(*Reprinted from "American Machinist," October 29, 1942.*)

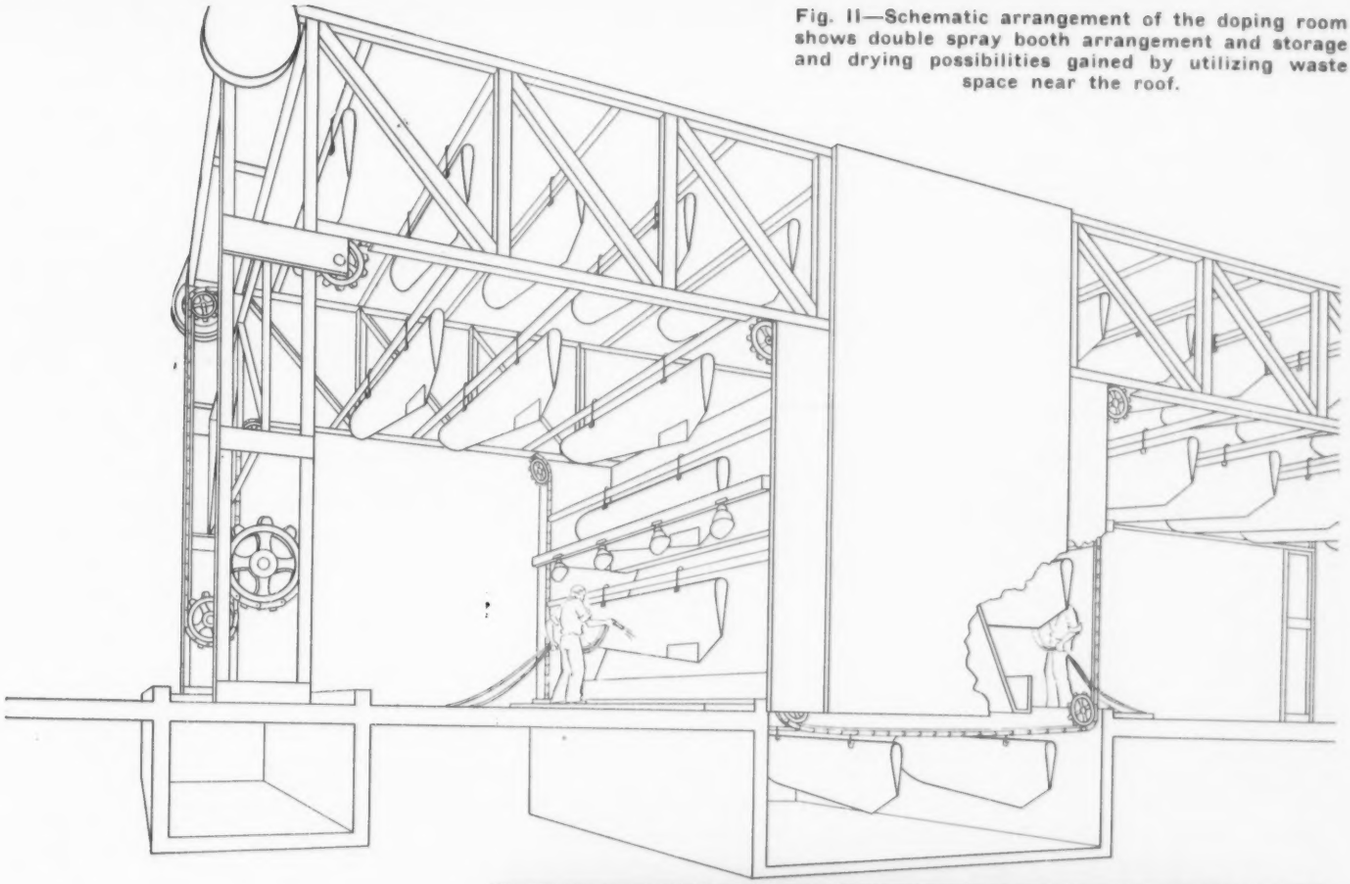


Fig. II—Schematic arrangement of the doping room shows double spray booth arrangement and storage and drying possibilities gained by utilizing waste space near the roof.

oven for complete drying prior to dipping in the primer.

The dip tank conveyor is driven by a ¼-hp. motor with a 50-1 reduction drive, at a speed of about 12 ft. per min. At this speed, parts emerge from the primer at such a rate that the surface tension gives a smooth coat of primer on the parts. For best results the primer is reduced, 2½ parts thinner to one part primer, before being added to the tank.

A more extensive saving in floor area was made by utilizing waste space near the ceiling in the rooms where control surfaces are primed or doped. Change in arrangements to utilize overhead conveyors gave an increase of several hundred percent in production without increasing floor area.

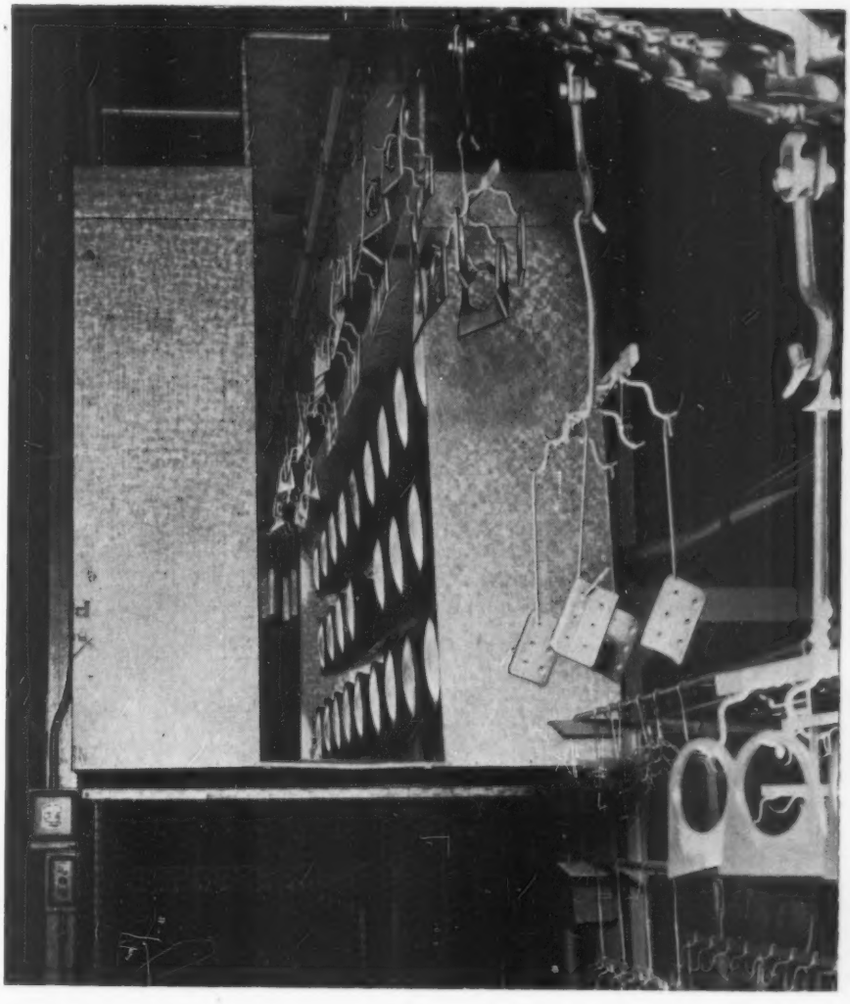


Fig. III—This infra-red oven dries moisture remaining on the parts after rinsing. It has 28 1,000 watt Hall reflector type lamps on each side in a tunnel of galvanized sheeting. These provide sufficient heat to dry the parts thoroughly. Hooks which carry the racks are held on a chain powered by Link-Belt drive.

Review of Industrial Finishing Progress for 1942

By G. KLINKENSTEIN

Vice President and Technical Director
Maas & Waldstein Company
Newark, N. J.

THE insistent demands of our war production industries and the drastic restrictions imposed by war conditions multiplied the research problems that had to be solved by the manufacturers of industrial finishes during the past year.

Much of this research work was devoted to improving government specifications in order to meet the special requirements of individual industries, eliminate bottle-necks, and help speed up production. In addition, an almost complete new line of ornamental and protective coatings in which no critical materials are used had to be developed for low-priority applications.

Fortunately, research has always been a major activity of many makers of finishes, and neither our war effort nor non-essential civilian industry has had to suffer from a lack of suitable coatings. However, the civilian demand for finishes is steadily declining, and most of the industry's productive facilities have been converted over to making protective coatings for war material.

Advances Made During 1942

Glossy and matte lacquers, lacquer-enamels and enamels for all purposes have been formulated from materials that are readily available in the United States and are not likely to be pre-empted by the war industries. Satisfactory wrinkle enamels have also been made up from domestic materials.

The popular metallic-lustre lacquers and enamels which were formerly made with aluminum powders, now unobtainable, have been replaced with others which contain a non-metallic lustrous material.

A reputedly acceptable substitute for electroplatings was found in a transparent lacquer-enamel. This finish, applied to polished metals, simulates brass, copper, bronze, color-treated aluminum and steel, and other metals.

New Products To Meet Wartime Demands

A clear or pigmented finish for resin-bonded plywood, used in making airplanes and speed boats was developed. It is resistant to rain, snow, heat, cold and other atmospheric conditions, and can be either air dried or force-dried.

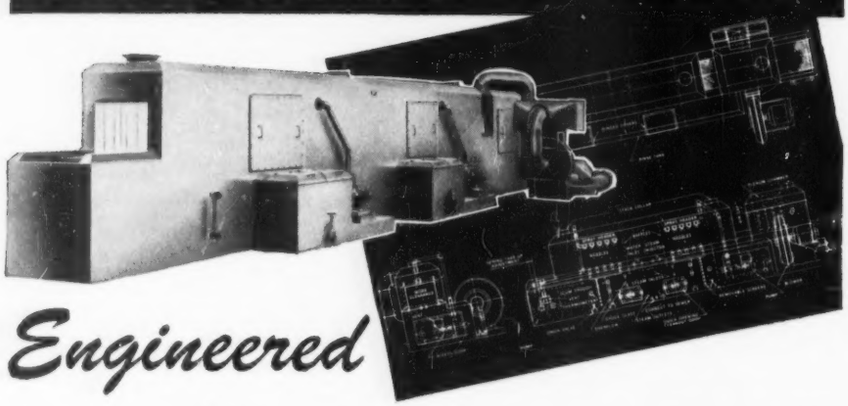
A luminous paint, used to make objects visible during blackouts, was another new development. It owes its luminosity to a non-radioactive substance which is activated by daylight or ordinary electric illumination. After a few minutes' exposure to light, it glows for hours, and, upon re-exposure, will react the same way.

A transparent coating which gives ordinary glass the property of safety glass in that it does not shatter when broken by severe vibration is also credited to the year's advances. This new product may play an important part in civilian defense, inasmuch as many casualties during air raids are due to flying pieces of glass.

NEXT MONTH

The second installment of the article entitled "Finishing Warplanes" by Frank V. Faulhaber will appear in the February issue of the Organic Finishing Section of *Metal Finishing*. The first part of this article was presented in last December's issue.

DETREX METAL PARTS WASHERS



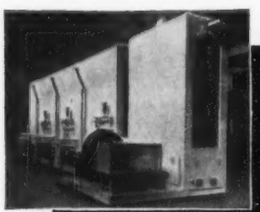
Engineered

TO MEET *Your* METAL CLEANING NEEDS

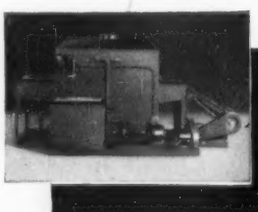
Detrex Washers—using alkali cleaning compounds, petroleum spirits or emulsion cleaners—are engineered to the customer's need. Incorporated is every detail which can contribute to long life and high efficiency.

Among the features of Detrex Washers are heavy, reinforced construction; balanced heat input; fully effective drying equipment, and proper directional spraying. Large access doors permit easy inspection, cleaning and adjustment of spray nozzles. Each washer with self-contained conveyor is equipped with variable speed drive. Conveyors used include monorail, slat belt and roller types.

Various models of Detrex Washers are pictured and described in the new catalog—"Detrex Metal Parts Washers". Write for your copy.



Four stage alkali spray washer with monorail conveyor. Used in cleaning of gun barrels, mounts and miscellaneous parts.



Single stage, through type, spray washer built with mesh belt, slat type or double strand conveyor.

SOLVENT DEGREASING and ALKALI CLEANING

DETROIT REX PRODUCTS COMPANY

13009 HILLVIEW AVENUE • DETROIT, MICHIGAN

Branch Offices In Principal Cities of U. S. A. — In Canada: Canadian Hanson & Van Winkle Co., Ltd., Toronto, Ontario

U. S. GOVERNMENT SPECIFICATION FINISHES

". . . a lacquer, air drying, and thinner for oxidized brass eye rims for gas masks . . . shall dry hard within 7 minutes after spraying on a brass plate . . . when sprayed on an eye-ring shall not show abrasion, chipping or peeling when crimped in position . . ."

These are just a few excerpts from a rigid specification required by our government for the metal finish on gas masks. ☆ Our booklet "Information on U. S. Government Specification Finishes," sent free on request, describes the specifications for various types of finishes, and the Maas & Waldstein products which have been developed to meet them. ☆ When new problems arise requiring special finishes, our laboratory will gladly assist you.

MAAS & WALDSTEIN COMPANY, NEWARK, N. J.

PRODUCERS OF LACQUERS, ENAMELS, SYNTHETICS AND SPECIALTY FINISHES FOR ALL PURPOSES
BRANCH OFFICES & WAREHOUSES: 1658 CARROLL AVE., CHICAGO, ILL. • 1228 W. PICO BLVD., LOS ANGELES, CALIF.

M&W

NEW EQUIPMENT AND SUPPLIES

LATEST COMMERCIAL DEVELOPMENTS IN ORGANIC FINISHING

Oil Burner

Hauck Manufacturing Company, 124-136 Tenth Street, Brooklyn, N. Y. have issued a new 16-page catalog describing their proportioning oil burners. It gives complete information concerning the burners along with diagrams for automatic control hook-ups, installation pictures, etc.

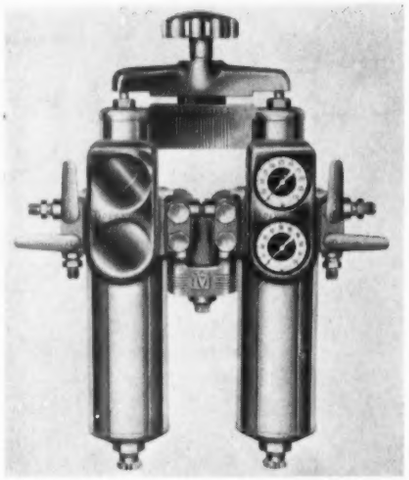
The burners described in the catalog are said to improve the efficiency and performance of ovens, air heaters and dryers.

A copy of the catalog may be secured upon request from the company.

Heavy-Duty Air Transformer

On many automatic spray painting installations and in other operations where a large volume of regulated clean air is needed, an air transformer of a capacity considerably greater than that of the standard type is required. To meet these conditions a new heavy-duty air transformer, the double barrelled Type HLC, with a capacity in excess of 100 C.F.M., has been developed and is announced by The DeVilbiss Company, Toledo, Ohio.

Though both function independently, the two pressure regulators in this transformer are simultaneously controlled by a single knob, making adjustment quick, easy and positive. The filtering and condensing mechanisms are the permanent, all metal type which never require replacement of any of their parts, as do the cotton waste kinds. The fast-acting regulator diaphragms are made of reinforced, oil-proof synthetic rubber and are chatterproof. Connection to the main air line is made at a single inlet port. No more fittings or piping are required than with single tube models.



Air Transformer

Protective Coatings

Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y., announce five new black rip-pls, one particularly interesting because it is made entirely from raw materials which are non-critical and for which no priority is required at present.

An enamel intended to resist weak acids and alkalis is another new item. It is said to pass the 72 hour test in a closed container in 1 per cent chlorine solution.

Other new items offered by the company are a combination primer and finishing enamel claimed to stand baking and designed especially for use on press fibre board. For a board which must air-dry, synthetic enamels and lacquers, trade-named FRANZITE, are available.

Masking Stickers

A new method of masking has been developed which is particularly effective when the mask area is small. "Kum-Kleen" stickers, which have a self-adhesive backing, may be easily peeled off without scraping or tearing after the operation is complete, it is said. They are quickly applied without moistening to metal, glass, plastic, wood, or any smooth surface. It is further claimed they will not pop off even under intense heat.

While standard sizes of "Kum-Kleen" labels will fit many normal masking jobs, special sizes and shapes are made to specifications. Much time and labor is saved in having a mask cut to exact requirements.

The Avery Adhesives, manufacturers of Kum-Kleen labels, are located at 451 East Third Street, Los Angeles, California.

Floor Masking Material

To speed up the job of removing accumulated spillage and overspray from paint room floors, Turco Products, Inc., 6135 S. Central Ave., Los Angeles, have developed a new floor masking material called "Turco Duramask."

This white, thick liquid looks and is handled much like paint and can be applied to the floor with a kalsomine brush. The manufacturers claim that it quickly dries to a hard, durable, non-skid surface which cannot be injured by ordinary foot or truck traffic. When the accumulation of paint on the protective coating is so great as to require removal, "Turco Duramask" can be dissolved with water and the paint film can be mopped away.

This material also can be used to protect machinery, walls, work benches and other surfaces from paint, oil or grease spillage, as well as act as a protective floor covering for garages, grease racks and machine shops, it is said. Lubricating oil, grease and machining oil are caught on the coating and prevented from seeping into the porous cement or wood floors. At intervals the spillage can be removed simply by mopping off with water. This new product is said to be non-corrosive, non-inflammable and not injurious to the skin. It can be written upon with an ordinary lead pencil. Inspectors can mark it with rubber stamps or dimensions can be layed out on its surface.

The Direct Drive Bench Type Marschke Buffer. 1 and 2 HP.
A Marschke "finishes" the best
SUPERB BUFFERS-FOR EVERY REQUIREMENT
THE MARSCHKE LINE includes Swing Frame Buffers—for large surfaces and heavy work pieces—as well as a variety of pedestal type machines with direct motor drive and multiple wheel speeds. Whatever your buffing requirement, there's a Marschke built to SAVE YOU MONEY. Marschke quality pays off in many trouble-free years of usefulness.
VONNEGUT MOULDER CORP. 1852 Madison, Indianapolis, Indiana.
Send for Marschke Swing Frame Buffer Circular No. 47
MARSCHKE QUALITY GRINDERS AND BUFFERS
VONNEGUT MOULDER CORP. INDIANAPOLIS

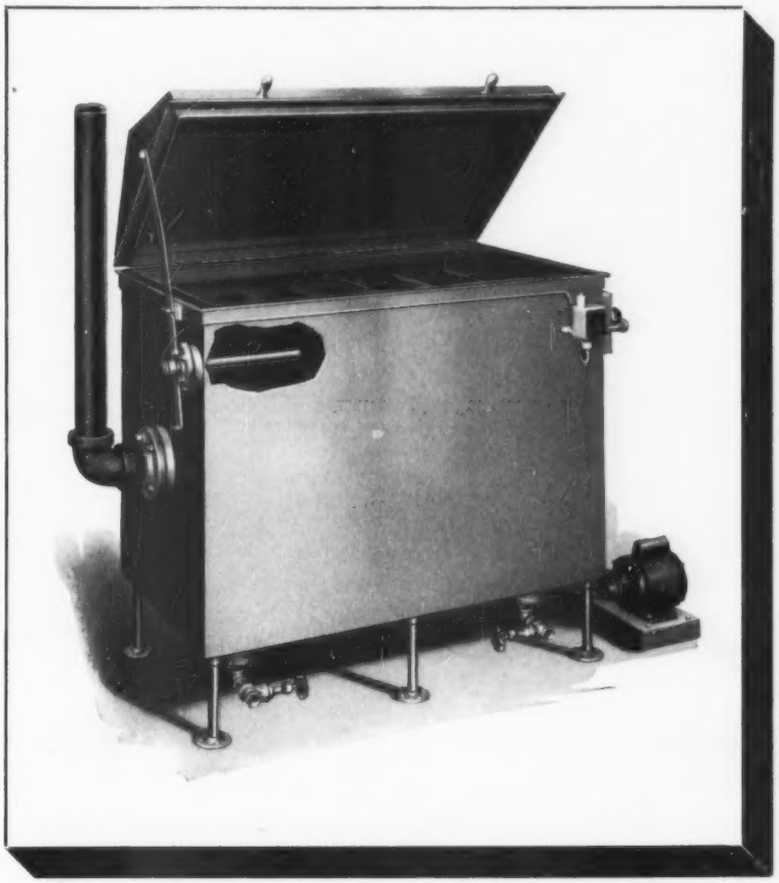
Salt Spray CORROSION TEST EQUIPMENT

Used by:

Electroplating Plants, Buyers of coated or plated metal & metal parts, Paint or Lacquer Laboratories.

Tests at controlled temperatures to conform with Army-Navy, Aeronautical specifications on Electroplated parts, as outlined in Bulletin AN-QQ-S-91-5 dated Dec., 1938 can very accurately be conducted.

These units can also be supplied without the temperature control, if this device is not required.



Designed to:

determine the corrosion resisting qualities of Electroplated or coated metal, Alloys, Metal Parts, Lacquered or Painted samples, etc.

The U. S. Bureau of Standards recommends the Salt Spray Test for this type of examination.

Special Features

This equipment combines all the necessary features, so that salt spray tests can be conducted to specifications at controlled temperatures from 65 to 140 Deg. Fah.

Temperature is accurately controlled by close adjustment of the temperature control switch, which controls immersion heaters within the Salt Water Compartment of cabinet.

The heated salt water when atomized creates the desired temperature within the testing chamber.

TESTING CABINET COMPLETELY COVERED ON INSIDE WITH 1/8″ THICK RUBBER

Spray tips are made of glass, and can be adjusted to density of spray required. Air compressor is driven with ⅓ H.P. motor, suitable for constant duty.

Standard Sizes

No. 1	**48″ long**	**26″ wide**	**36″ deep**
No. 2	**36″ long**	**24″ wide**	**30″ deep**
No. 3	**30″ long**	**18″ wide**	**30″ deep**
No. 4	**24″ long**	**15″ wide**	**30″ deep**

Note:—On all sizes the SALT WATER COMPARTMENT with ATOMIZER and SPRAY BAFFLE assembly consumes an area 10″ long & 18″ high across the width at one end of the bottom inside of cabinet. (Ample space remains for racking longer pieces the full length of the upper part, and for smaller articles in the lower part of the testing chamber.)

Sturdy rubber covered angle bars are supplied with each unit on which to rack pieces to be tested. Special racking arrangement can also be supplied when specified.

(These units can be supplied without Compressors where a source of compressed air is available.)

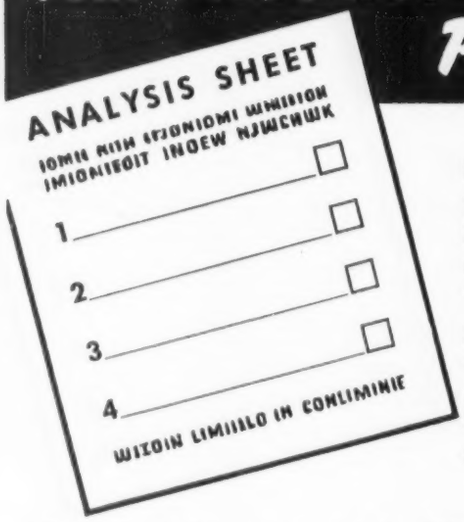
SALT SPRAY TEST is the standard by which rust resistance is measured.

The quality of plating can be certified and serious losses avoided by checking production with systematic tests. Products tested in this manner enjoy a definite advantage in selling, as the salt spray test now widely used means protection and satisfaction to buyers of plated or coated metals and metal parts.

INDUSTRIAL FILTER & PUMP MFG. CO.

3017 WEST CARROLL AVENUE **CHICAGO, ILLINOIS**

Here's QUICK HELP on Your PRODUCT CLEANING Problem....



Finding the correct answer to your product cleaning problem starts with the analysis of its particular requirements. To help you clarify your problem and get the assistance of our technical staff, a copy of our simple Product Cleaning Check Chart will be sent you, without obligation.

Send today for this FREE Analysis Sheet

We are product cleaning specialists, and make no attempt to apply a standard formula to your job. We study your needs, then supply a cleaning preparation engineered to meet your exact needs. Many leading manufacturers have been surprised at the speedier production and the savings in labor and materials which our specialized cleaning preparations bring them. Our experience should be equally helpful to you.

Write us about your product cleaning problem, or send for the Analysis Check Chart. There is no obligation.

HUNNEWELL SOAP CO.
116 W. SECOND ST., CINCINNATI, O.
OVER 100 YEARS OF SERVICE TO INDUSTRY

Manufacturers' Literature

Airpainting Equipment

Paasche Airbrush Co., 1909 Diversey Parkway, Chicago, Ill. have issued a booklet entitled "Paasche Airpainting Speeds Production."

The booklet consists of 8 pages, is illustrated and gives specifications of various air brushes, cup assemblies, pressure tanks, syphon cup units and other equipment offered by the company.

Petroleum Naphthas

A 4-page leaflet on industrial petroleum naphthas including a chart of evaporation rates of various solvents and "Amsco" petroleum solvents was issued by *American Mineral Spirits Co.*, 230 N. Michigan Ave., Chicago, Ill. This literature is identified as Leaflet CEN.

Paint Progress

The current issue of *Paint Progress*, publication of *The New Jersey Zinc Co.*, 160 Front St., New York City, emphasizes the growing appreciation of the important function of paint during war-time. Subjects such as painting for dimout purposes, for war-plant light, for the protection of bombs and for the conservation of wood and metal, make up the major portion of the text.

Of particular interest are the remarks of the War Production Board concerning the necessity of proper lighting conditions in those plants turning out vital war materials.

A review of the development of resin-oil emulsion paints and zinc sulfide pigments is also featured.

Addition Agent for Alkaline Cleaning Baths

Hercules Powder Company, Wilmington, Delaware, has recently issued a booklet describing "Dresinate," a free-flowing, water soluble addition agent for alkaline cleaning baths. According to the description, Dresinate has no chemical action on soft metals and is equally effective in strong or weak alkaline baths. Substituted for 5% to 10% of the total alkali normally used, it is said to develop two assisting actions—rapid wetting of the metal surface coupled with emulsification of oils, greases, etc. and dispersion of these soils into stable, relatively permanent dispersions which can be quickly rinsed away to leave a clean surface fully prepared for further treatment.

Patents

Lacquer Solvent & Composition

U. S. Pat. 2,305,511 F. A. Bent & F. B. Hilmer, assignors to Shell Development Co., Dec. 15, 1942. A composition of matter comprising a film-forming material of the group consisting of the cellulose ethers and cellulose esters which are soluble in organic solvents dissolved in a solvent containing methyl isobutyl ketone and methyl isobutyl carbinol in the volume ratio of from about 2.3 to 19 volumes of methyl isobutyl ketone to 1 volume of methyl isobutyl carbinol.

Organic Coating

U. S. Pat. 2,305,497 A. L. Rummelsburg, assignor to Hercules Powder Co., Dec. 15, 1942. A coating composition adapted to be applied to a transparent base and having the property of drying to a transparent permanently haze-free film and comprising from about 25 to about 60 percent of a cellulose derivative selected from the group consisting of cellulose ethers and cellulose esters, from about 20 to about 60 percent of a polymerized rosin having an acid number of at least about 100 and less than about 140, and a volatile organic solvent in sufficient amount to yield a readily flowing mixture capable of application in a thin even film.

Spray Gun

U. S. Pat. 2,303,280 A. F. Jenkins, Nov. 24, 1942. A spray gun of novel design for coating materials.

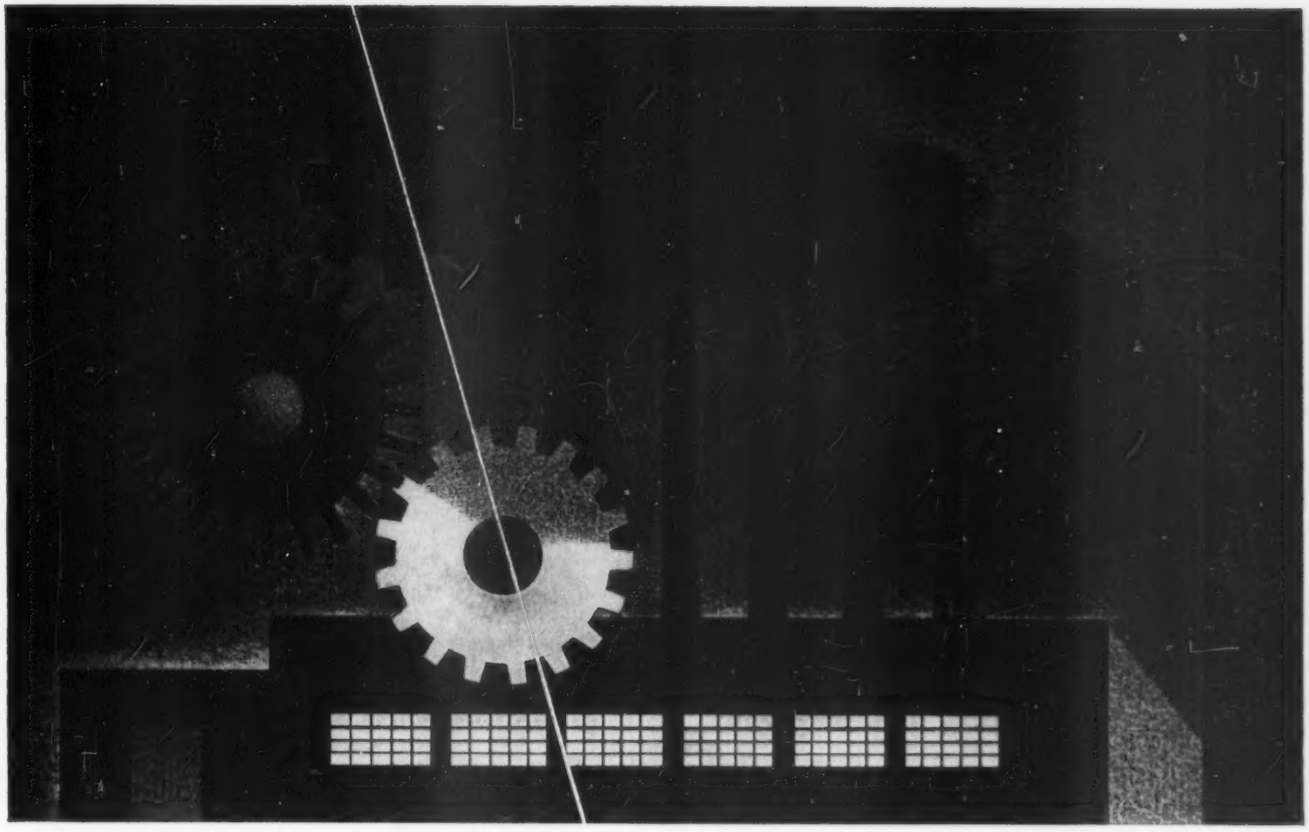
Organic Coating

U. S. Pat. 2,299,096 J. L. Krieger, Oct. 20, 1942. A process for the prevention of discoloration of clear lacquer compositions used for dipping copper and copper containing material which comprises adding thereto a small amount of a phosphite compound having the general formula $R_1R_2R_3PO_3$ where R_1, R_2 and R_3 are from the class consisting of hydrogen and organic radicals, the amount of said phosphite being sufficient to prevent said discoloration.

Example:

Dioxane	100 parts
Phosphorus acid	15 "
Clear lacquer	5 "

Use 0.1% of the above in the lacquer.



Demands of industry

Today's technical development is so rapid that it makes the progressive company of two years ago seem to have been standing still. Many of these developments are still military secrets, but you must take them into account NOW in your post-war planning. For today's advance becomes tomorrow's headache . . . unless it is in YOUR plant. What your competitor does affects your sales just as drastically as what you do yourself. Product improvements mean loss to you . . . unless they are YOUR improvements. Product improvements don't just happen. They usually require specialized engineering talent and research. It is our business to discover better ways to finish products . . . to cut finishing time, to lower finishing costs, to improve appearance and utility . . . to keep your product abreast and, if possible, AHEAD of competition. Your inquiry will incur no obligation. Address The Stanley Chemical Company, East Berlin, Connecticut.

Stanley Chemical

Shop Problems

Problem 5. Cost of Aluminum Finishes

Problem: An aluminum finishing material to be used on steel fittings is mixed according to the following formula:

Aluminum paste	0.5 lb.
Vehicle	1.0 gal.
Reducer	0.5 gal.

Calculate the unit material cost if one gallon of the mix is required for each 35 pieces finished.

The aluminum paste has a specific gravity of 1.47 and costs $0.90 per pound. The vehicle costs $2.40 per gallon and the reducer $0.86 per gallon.

Solution: 0.5 pound of the aluminum paste of specific gravity 1.47 occupies a volume of 0.041 gallon, calculated as follows:

$$\frac{0.5}{1.47 \times 8.33} = 0.041$$

Therefore, the total volume of the formula mix of paste, vehicle and reducer is (0.041 + 1.0 + 0.5) = 1.541 gallons. (It is assumed that the volumes of paste, vehicle and reducer are additive.)

The cost of this mix of 1.541 gallons is (0.5) ($0.90) + (1.0) ($2.40) + (0.5) ($0.86) = $3.28. Therefore, the cost per gallon of mix is $\frac{\$3.28}{1.541}$ = $2.13 and the material cost per unit finished is $\frac{\$2.13}{35}$ = $0.061.

Next Month: Sprayer Efficiency.

Aluminum Paints

Question: What is the difference between high heat resisting aluminum paints and regular aluminum paints?

Answer: We believe that the heat resisting aluminum paints to which you refer are those which use a special vehicle. This vehicle, which allows the application of the material in any of the ordinary ways, is mostly lost without discoloration when exposed to high temperatures. Although the vehicle is lost, the material continues to adhere, probably because of a semi-metallurgical action which takes place between the powder and the metal to which it is applied. In other words, the curing of heat resisting aluminum paint is probably not a curing process but rather a driving off of the vehicle followed by a bonding of the aluminum to the metal under the action of elevated temperatures.

Tumble Finishing

Question: We wish to apply a thin coating of lacquer to the outside of metal tubes, 1½" long, ½" in diameter and open at one end. We understand that this can be accomplished by tumbling the parts in a barrel while spraying in the lacquer.

We have attempted finishing these parts by this method but have not been too successful. The lacquer tends to dry too quickly and flakes off. The flakes adhere to the surface, giving a poor appearance. Our equipment consists of an oak barrel, 2 ft. in diameter, operating at 64 R.P.M. A motor driven paint sprayer is used.

Any help you will give us will be most welcome.

Answer: The speed and angle of the barrel are quite suitable for the type of work to be finished. Many finishers prefer a metal barrel or a nickel or cadmium plated mesh basket in a wooden barrel. The barrel should be loaded about one-third full and the lacquer sprayed from the bottom toward the top of the load. After the parts are coated, they should be placed in trays and shaken occasionally to keep them separated while drying.

It is possible that the lacquer which you are using is not suitable for tumble finishing, perhaps because the solvents evaporate too quickly. Your finishing material supplier could recommend slower thinners or a retarder to add to the thinner.

It is essential, of course, that the work be perfectly clean and dry. Traces of cleaning compound on the surface of the work or small amounts of water could cause poor results.

Remember Pearl Essence

The Selective Substitute for Metallic Finishes

GUNMETAL **NICKEL**

BRASS **BRONZE**

Available in Unlimited Quantities

THE MEARL CORPORATION

153 Waverly Place **New York, N. Y.**

Reclaiming of Used Drums

Thousands of steel drums and barrels, which would be junked in normal times are being reclaimed under a new reconditioning plan developed by the Chicago plant of the Sherwin-Williams Company. The drums are used for bulk shipments of camouflage paints for ships, tanks and other ordnance finishes supplied by the company to war plants throughout the country.

Forced into the reclamation project by shortages of steel, the Sherwin-Williams Company reclaims rusty and gummy drums again and again by an ingenious chemical treatment. The process is far more costly than using new drums, but many tons of metal are thus saved for war equipment.

NALCO Dritherm CARBON FILAMENT Lamps

Best For Infra-Red Ray Drying

Nalco Dritherm (Infra-Red Ray) Lamps cut heating and drying costs . . . save time . . . require minimum space . . . produce uniform and controlled results.

Dritherm Lamps are the Carbon Filament type, the type best suited for the Infra-Red Ray process. They are available in the Clear glass for use with reflectors or the Inside-Silvered type, which are self-reflecting. The Inside-Silvered is made in the R-40, (250 Watt). The Clear glass is made in sizes from 128 Watt to 500 Watt.

NALCO REFLECTORS are available in the 7⅝" diameter and the 10¼" diameter . . . in the gold-plated finish. These reflectors may be purchased separately so that users can make up their own equipment.

NALCO STRIP UNITS—sockets, reflectors and lamps mounted on Curtistrip enable the user to assemble a complete infra-red installation with a minimum of trouble and expense.

NALCO INFRA-RED DRITHERM

North American Electric Lamp Co.
1043a Tyler St. St. Louis, Missouri

Faster **FINISH BAKING** *Speeds* **WAR SUPPLIES**

DESPATCH Continuous Type Oven Sets New Records

With construction features geared to round-the-clock operation, Despatch ovens are setting new records in several large plants — for greater output of high quality finish-baking.

Your plant can likewise profit immediately from the faster baking provided by these units.

- BAKES FASTER using larger heater-fan-duct combination. Saves fuel.
- EASY HANDLING with continuous or batch-type loading systems, horizontal or vertical. Saves labor.

WIRE OR PHONE TODAY! Let a Despatch engineer recommend the RIGHT equipment for your plant. Ask for Bulletin 51-MF.

DESPATCH OVEN COMPANY

The Buy-Word Is *"Enthone"* for ENAMEL STRIPPERS

For the past 4 years Enthone strippers have been used by hundreds of manufacturers for quickly removing organic finishes from civilian goods.

And NOW—fast working, patented* Enthone strippers are helping to speed the flow of war goods.

Here's what Enthone strippers do:

★ Strip synthetics, japans, lacquers rapidly.
★ Leave all metals clean and bright.

SPECIAL STRIPPERS for SPECIAL PROBLEMS — TELL US YOUR PROBLEM!

THE *Enthone* CO.

*Protected by U.S. Patent No 2242106 NEW HAVEN, CONN.

DO YOU WANT TO RECEIVE

ORGANIC FINISHING

EACH MONTH?

Write

ORGANIC FINISHING

11 West 42nd Street New York

CUT DRYING TIME . . . USE A

KREIDER *Centrifugal Dryer*

ON YOUR PLATED PARTS

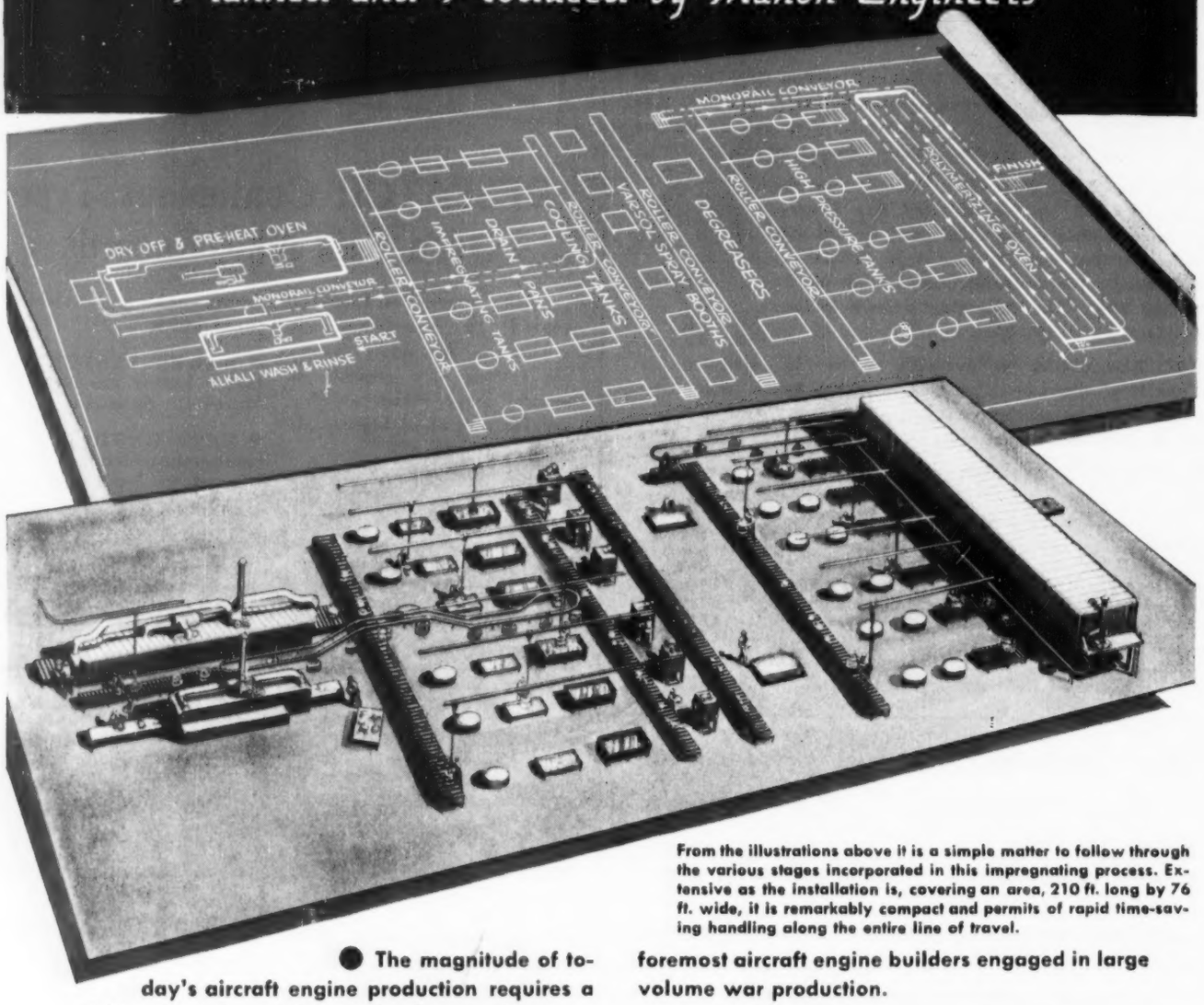
Here's a modern, high speed drying outfit that will give you fast, low-cost drying and, at the same time, improve plating quality. Sturdy, simple design. All steel, welded construction. Controls include foot brake and reversing drum. V-belt drive; anti-friction bearings. Auxiliary heating unit available.

Write for complete information and prices.

DELLINGER MANUFACTURING CO.
727 North Prince St., Lancaster, Penna.

Impregnating System for Magnesium Castings

Planned and Produced by Mahon Engineers



From the illustrations above it is a simple matter to follow through the various stages incorporated in this impregnating process. Extensive as the installation is, covering an area, 210 ft. long by 76 ft. wide, it is remarkably compact and permits of rapid time-saving handling along the entire line of travel.

● The magnitude of today's aircraft engine production requires a daily output of many thousands of magnesium castings. As magnesium castings are extremely porous, they must be thoroughly impregnated with tung oil in order to seal the pores.

The installation, pictured above, was planned and built for this purpose by Mahon engineers. It is now in the process of installation for one of the foremost aircraft engine builders engaged in large volume war production.

The ability of Mahon engineers to produce such a system is tangible assurance of the *specialized* assistance they can extend to you. For years they have been concentrating on the development of equipment essential to product finishing and the many processes related thereto. The knowledge they have acquired is completely at your disposal.

Metal Cleaning Machines, Rust Proofing Machines, Hydro-Filter Spray Booths, Ovens of All Types, Filtered Air Supply Units, Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment—including Complete Finishing Systems.

THE R. C. MAHON COMPANY • DETROIT • CHICAGO

MAHON

Supply Prices, January 4, 1943

Anodes

Prices are f.o.b. shipping point on quantities of from 500-999 lbs. for copper, brass and zinc. For nickel, prices are for quantities from 500-2,999 lbs.

COPPER: Cast, elliptical, 15" and longer	25⅛c. per lb.	ZINC: Cast, 99.99, 16" and over	16¼c. per lb.
Electrolytic, full size, 22⅞c; cut to size	22⅞c. per lb.	NICKEL: 95-97 cast, elliptical 46c. per lb., 99% plus cast 47c.; rolled, depolarized	49c. per lb.
Rolled, oval, straight 15" and longer 23¼c. per lb.; curved	24¼c. per lb.	SILVER: Rolled, .999 fine per Troy (1-9) oz.	58c. per oz.
BRASS: Cast, 80-20, elliptical, 15" and longer	23⅝c. per lb.		

Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone, C.P., drums, l.c.l.	lb.	.09
Acid, Boric tech., 99.5% gran., bbls.	lb.	.0635
Chromic, 99%, 100 lb. drums, l.c.l.	lb.	.1825
Hydrochloric (muriatic) tech., 20°, carboys, wks	lb.	.027
Hydrochloric (muriatic) tech., 22°, carboys, wks	lb.	.19
Hydrofluoric, 30% bbls.	lb.	.06
Nitric, 36°, carboys 1-9, wks.	lb.	.0595
Nitric, 42°, carboys 1-9, wks.	lb.	.0745
Oleic (Red Oil), distilled, drums	lb.	.1225-.1325
Oxalic, bbls. l.c.l.	lb.	.125
Stearic, distilled, double pressed, bags	lb.	.14-.15
single pressed, bags	lb.	.135-.145
triple pressed, bags	lb.	.17-.18
Sulphuric, 66°, carboys 1-9, wks.	lb.	.0245
Alcohol, Amyl (Fusel oil, ref'd), l.c.l., drums	lb.	.151
Butyl-normal, l.c.l., drums	lb.	.1225-.1575
Denat., S.D. #1, 190 pf., 1-18 drms., wks.	gal.	.64
Diacetone, tech., drums, l.c.l.	lb.	.1175-.15
Methyl, (Methanol), 95%, drums, l.c.l.	gal.	.37
Propyl-Iso, 99%, drums, l.c.l.	gal.	.47
Propyl-Normal, drums, wks.	gal.	.67-.70
Alum, ammonia, granular, bbls., works	lb.	.04
Potash, granular, bbls., works	lb.	.0425
Ammonia, aqua, 26°, carboys	lb.	.0525
Ammonium, chloride (sal-ammoniac), white, granular, bbls., wks.	lb.	.0515
Sulphocyanide (thiocyanate), pure, crystal, dms.	lb.	.45-.55
Sulphocyanide (thiocyanate), tech., kegs	lb.	.40
Antimony Chloride (butter of antimony), sol., carboys	lb.	.17
Barium Carbonate, pptd., bags, l.c.l., works	lb.	.03
Benzene (Benzol), 90%, drums, works	gal.	.20
Butyl Lactate, drums	lb.	.265
Cadmium Oxide, l.c.l., bbls.	lb.	.95
Calcium Carbonate (Pptd. chalk), c.l., wks.	ton	$40.00
Carbon Bisulphide, l.c.l., 55 gal. drums	lb.	.0575
Carbon Tetrachloride, l.c.l., drums	gal.	.80
Chromic Sulphate, scale, 100 lb. drums	lb.	.45
Cobalt Sulphate, drums	lb.	.71
Copper, Acetate (verdigris), bbls.	lb.	.26-.35
Carbonate, 52-54%, bbls.	lb.	.165
Cyanide, Tech., 100 lb. bbls.	lb.	.34-.38
Sulphate, 99%, crystals, bbls., 1-5	lb.	.0565-.06
Cream of Tartar (potassium bitartrate), gran., kegs	lb.	.585
Crocus Martis (iron oxide) red, bbls.	lb.	.09
Dextrin, white, bags, F.O.B. Chicago	lb.	.0415
Dibutyl Phthalate, drums, l.c.l.	lb.	.2050-.2120
Diethylene Glycol, drums, l.c.l., works	lb.	.155
Emery (Turkish)	lb.	.08
Ethyl Acetate, 85%, l.c.l., drums, works	lb.	.1220-.1250
Ethylene Glycol, l.c.l., drums, works	lb.	.155-.165
Monoethyl ether, dms., l.c.l., wks.	lb.	.125-.155
Gold, Chloride, yellow, bottles	oz.	$19.25
Cyanide, potassium 41%, bottles, wks.	oz.	$14.20-$14.95
Gum. Arabic, white, powder, bbls.	lb.	.33-.35
Hydrogen Peroxide, 100 volume, carboys	lb.	.16-.185
Iron Sulphate (Copperas), cryst., bbls., 1-4 wks.	lb.	.02
Lead, Acetate (Sugar of Lead), crystals, bbls.	lb.	.125
Oxide (Litharge), com., powdered, bbls.	lb.	.09
Magnesium Sulphate (Epsom Salts), tech., bbls.	lb.	.019
Mercury Bichloride (Corrosive Sublimate), crys.	lb.	$2.39
Mercuric Oxide, tech., red, powder, bbls.	lb.	$3.26
Nickel, Carbonate, dry, bbls.	lb.	.36-.365
Chloride, bbls.	lb.	.18-.20
Salts, single, 425 lb. bbls.	lb.	.135-.145
Salts, double, 425 lb. bbls.	lb.	.135-.145
Paraffin, refined, bgs., 123-125 a.m.p., c.l.	lb.	.0520
Perchlorethylene, drums, l.c.l.	lb.	.095
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yellow, cases	lb.	.23-.25
Potash, Caustic, 88-92%, flake, drums, works, c.l.	lb.	.07
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Cyanide, 94-96%, dom. dms., wks.	lb.	.55
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Nitrate, 100 oz. lots	oz.	.32⅝
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Sesquisilicate, 1-9 bbls.	lb.	.0430
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Trichlorethylene, drums, l.c.l., zone 1	lb.	.085
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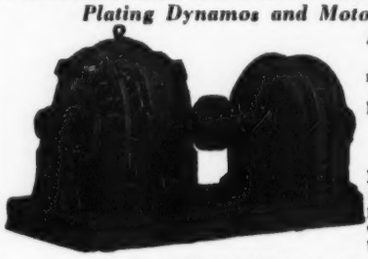

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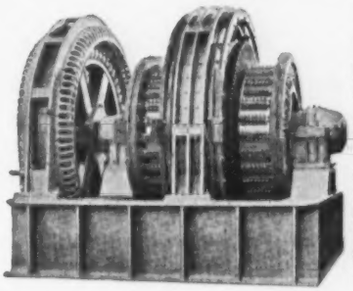

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Odds and Ends

Cadmium Disease

On advertising page 36 of the December 1942 issue, the editors of the renowned medical journal, METAL FINISHING, published a short but interesting treatise on a cadmium disease which flares up at intervals.

According to the author, the corpus publicum suffers from an acute deficiency of cadmium. One might have expected the author to have analyzed the causes of this deficiency but no such attempt was made. It is suggested here that the deficiency is caused only to a minor extent by insufficient supply. One of the reasons is undoubtedly that during the past few months the corpus publicum has been pregnant and has had to give up a good part of its cadmium intake to the new babies being formed. Now, since most of the babies have been born, this reason will disappear. The pregnancy also appears to have caused low metabolism. Much of the cadmium intake has been wasted by faulty elimination. In its delicate condition the body just rejected too much material which was coated with cadmium. There has also been evidence of abnormal accumulation of cadmium in certain parts of the body—a situation rather quickly overcome by the recent prescription of a lean diet.

Although there is much evidence that the present condition will become rectified by the normal restorative ability of the body, the author of the above-mentioned treatise, apparently under the influence of shock or hysteria, recommended a stiff dose of Grandma's home remedy, Zincum. Now it is undoubtedly true that Zincum will overcome certain effects of cadmium deficiency, but to make it out as a universal remedy is most dangerous. The author admits that many people are allergic to this nostrum just as they are allergic to sulpha drugs, but that does not seem to worry him in the least. Since Grandma did not bother about allergies, why should granddaughter complain about headaches? Is the author an aspirin addict?

Like all remedies Zincum must be prescribed with some care. Thus for example, the most common type of Zincum is combined with cyanide. In this combination it causes embrittlement of flexible parts of the corpus publicum which cannot be overcome by the usual application of thermotherapeutic means. Also, it has been found that Zincum may cause atrophy of the optic and acoustic nerves. These are just a few examples of organs which are seriously affected by the use of Zincum, organs which must be kept in good condition if the corpus publicum shall maintain itself during the present war.

The Food and Drug Act prohibits misleading advertising of patent medicines. Please, dear Editors, see to it that this law be obeyed also in the case of Grandma's "All-purpose Zincum".

VOX HUMANA

(The foregoing communication, refuting the findings published on this page in last month's issue, was received from one of the nation's foremost gynecologists and diagnosticians. Professional ethics prevent the disclosure of the name of this famous healer, but his initials and the hospital of which he is Chief Surgeon are Gus Soderberg and The Udylite Corporation, respectively.

The reader now has a choice of symptoms, but in any case, both authorities agree there *is* a disease.—Ed.)

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pH and Fancy Numbers

A pH change of one unit does not excite the imagination but what does it mean? A change in pH of from 5 to 6, or one unit, involves a change of only one millionth of an ounce per gallon in the hydrogen ion concentration. Not much, did anyone say? Only a change of six billion billion molecules which, if written out would look like this: 6,000,000,000,000,000,000. These molecules weigh about one-quarter of a millionth of a billionth of an ounce each and have a diameter of a hundredth of a millionth of an inch.

Rare (?) Metals

There are many surprising features about the incidence of various metals in the earth's crust. Zinc is considered a common metal so who would expect it to be more rare than a metal like cerium? "Rare" metals like yttrium, neodymium and lathanum are more abundant naturally than lead and even lutecium is not as scarce as either cadmium or mercury. We would hardly expect to find cadmium to be much rarer than uranium yet it is. Much of the abundance of the well-known or common metals is due to their segregation in large deposits and the relative ease with which they can be extracted.

Tin as a Protective Coating

Although tin ordinarily is understood to protect ferrous metals mechanically in the same manner as does nickel—that is, by covering the exposed ferrous surface, this is not always true. In many cases, tin acts in the same way as zinc and cadmium; that is, it protects by chemical sacrificial action. In many dilute acids, especially organic acids such as citric and oxalic acid, tin dissolves in preference to the iron base to form a complex. In other acids, such as sulfuric acid, tin does not dissolve to any extent and is cathodic to the iron so that the base metal exposed at the pores is attacked. In other cases, upon immersion tin is cathodic but becomes anodic to iron after a very short time.

The value of 30 pieces of silver, which Judas Iscariot received for betraying Jesus Christ, amounted to about $20.00 in value today, the price of a slave.

Aluminum occurs more abundantly throughout the world than any other metal.

Silver and its alloys are helping to build battleships, bombs, guns, shells, tanks, torpedoes, trucks and airplanes. The use of silver bearings in airplanes makes possible increased speed and the ability to withstand shock and vibration.

Christmas Greetings

Christmas greetings were received from the following:

The Agate Lacquer Mfg. Co.
The Alling & Cory Co.
American Trading Co.
M. E. Baker Co.
Joe Barron
H. Leroy Beaver
Ed. Berry
Frank Best
D. X. Clarin, Oakite Products, Inc.
Samuel L. Cole, Chas. F. L'Hommedieu & Sons Co.
The Crosley Corporation
Burton Daw, Lasalco Co., Inc..
DeLaval Separator Co.
Denham & Co.
The Dow Chemical Co.
Father Flanagan of Boys' Town
Fred Fulforth
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Robert B. Goodsell
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Knapp Engraving Co., Inc.
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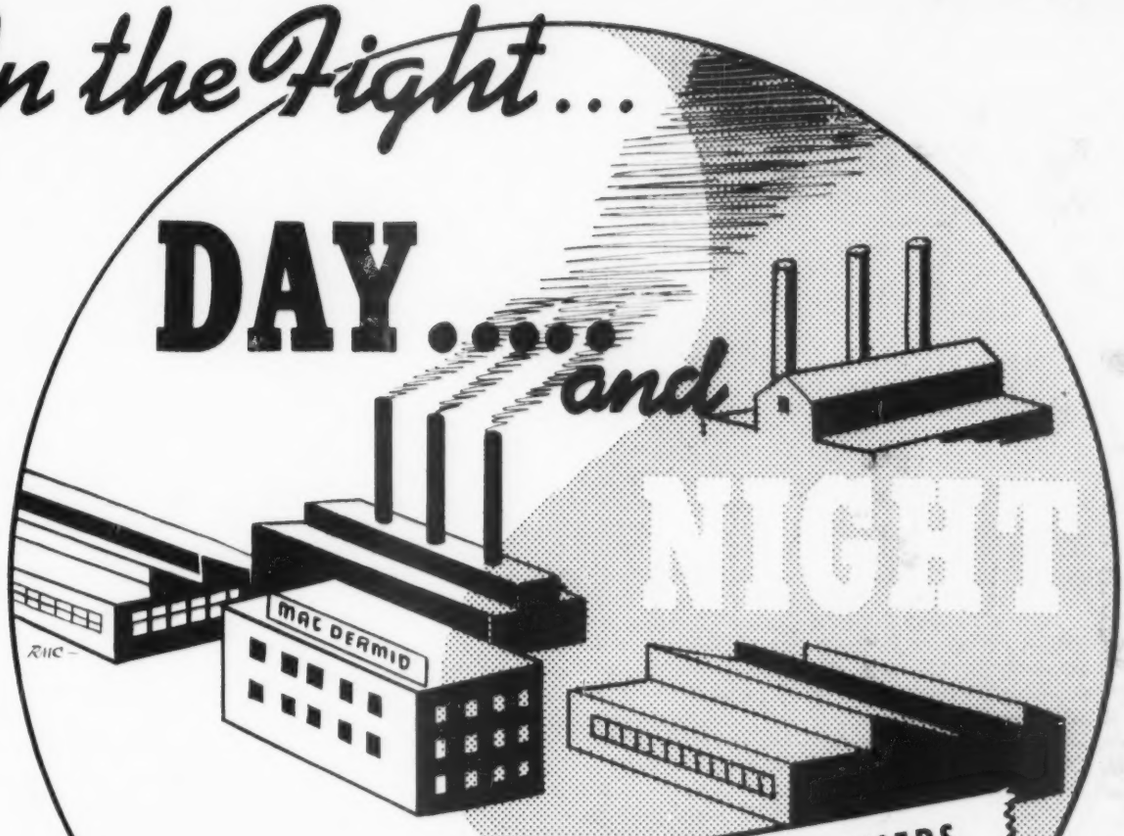
Tutrone Printing Co., Inc.
O. S. Tyson & Co., Inc.
United Engineering & Foundry Co.
Universal Engraving Co.
West Virginia Pulp & Paper Co.

Thank you! And Cordial Greetings and Best Wishes to All Our Friends!

In the Fight...

DAY.... *and* NIGHT



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